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THE PERCEPTUAL BASIS FOR MOBILITY

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The ability to travel safely, comfortably, gracefully, and independently, referred to hereafter by the single term "mobility," is a factor of primary importance in the life of a blind individual. The blind person who fails to acquire this ability usually displays a life style characterized by passive acquiescence to conditions proposed and arranged by others. The blind person who has acquired this ability often displays a life style characterized by the execution of plans of his own formulation. Yet, until recently, it was not generally recognized that mobility could be resolved into a collection of related subskills, and that these skills could be taught. Some blind persons did develop satisfactory travel techniques, but many did not, and those who did were often unable to specify their techniques or communicate them to others.

Dr. Richard Hoover's (1950) success in working with blinded war veterans is well known. From that beginning, fairly elaborate training programs have been developed for both trainees and trainers. The success of these programs is beyond question. Many blind persons have been emancipated from lives of passive dependence.

Although the effort to state practical objectives, and to provide experiences conducive to the realization of those objectives has been rewarded with significant success, we still lack a general theory of mobility to guide us in the refinement of training methods and the design of information-gathering instruments intended to assist mobility.

There is much to be learned before such a theory can be formulated and tested. We must learn how to measure significant aspects of total mobility performance in order to gauge the contribution of a wide variety of factors to that performance. Dr. J. A. Leonard (1968), of Nottingham University, has made an impressive beginning in this regard. We must assess more effectively those conflicts in personal objectives that sometimes keep a seemingly capable individual from achieving satisfactory mobility. But first, we must arrive at a clearer statement of the perceptual operations--both sensory and motor--that underlie successful mobility. It is knowledge of this sort that will tell us what to train for when we train, and what information to display with the mobility aids we construct.

To gain a better understanding of the task that confronts the blind pedestrian making his way through an obstacle-filled environment without primary reliance upon another individual, it may be instructive to compare his task with the task of a sighted pedestrian similarly engaged. When a person walks, it is usually safe to assume that he has an objective, that he is going somewhere. To achieve this objective he must make a succession of decisions about alternative courses of action, and to make these decisions he must collect information. The sighted pedestrian easily obtains much more information than he needs to plot a successful course. In a matter of seconds, he can collect enough information to construct a detailed picture of the terrain in which he is interested. He knows about the characteristics of the path on which he will walk (steps up and down, curves, surface irregularities, etc.) for a considerable distance ahead. He knows about the shapes and disposition of buildings, trees, lamp posts, fire plugs, or any of the countless objects in which landscapes abound. Furthermore, as he progresses along his course this picture is continually updated and renewed. If an item of needed

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information is lacking it can be obtained almost instantaneously.

It would be an interesting and possibly useful demonstration to allow a small group of individuals to inspect visually an unfamiliar cityscape for a short period of time, and then to elicit from them some representation of the information they had obtained. They might present this information in the form of a map, or a verbal description, or both.

The blind pedestrian, on the other hand, must negotiate his environment with a relative paucity of information. Whereas his sighted counterpart will always have much more information than he strictly needs, the blind pedestrian will generally have less information than he could conveniently use. As he pursues an intended course he will obtain information. He may sense by reflected sound the presence of objects in or beside his path. He may learn something about the surface characteristics of his path from the way it feels under foot. His course may sometimes be dependably marked with auditory, olfactory, or cutaneous cues. He may expand the sector of the environment from which he can obtain information proprioceptively by using a cane. He may even obtain information about the distance and direction of more distant objects by using an environmental sensing device, such as the Kay Sonic Aid (Kay, 1963). However, he will still have access to only a meager supply of information.

Because physical contact with the environment is not a requirement of the visual perceptual system, the sighted pedestrian is informed about the space through which he will move for a considerable distance. No matter how fast he walks he will not move into space about which he is uninformed.

In contrast, it is for the most part only by physical contact that the blind pedestrian is directly informed about those features of the environment, a knowledge of which is critical to successful mobility. It is true that physical contact is not a requirement for auditory or olfactory stimulation, but most objects in the environment do not emit distinctive sounds or odors; even when they do, the resulting stimulation does not directly specify the shapes of objects. The blind pedestrian is not directly informed about the space he will occupy with each succeeding step until he moves into it. The information he obtains about a space by occupying it may come too late to enter into course decisions. By using an environmental sensing device, such as a cane, he may learn something about the space within its range. However, with any of the devices now available he will not be able to collect enough information about the space it scans to specify that space very completely. Through skillful management of his device, he may be able to obtain information that is useful in staying on course and avoiding hazards, but he will have relatively little information in comparison to the sighted pedestrian. Furthermore, because of the limited range of presently known environmental sensing devices, the slow rate at which the terrain within their range can be scanned, and the time it takes to interpret their displays, the blind pedestrian can all too easily move beyond the space about which he is informed. He can reduce the effect of this problem by keeping his walking speed slow enough to bring it into proper relation with the rate at which he can collect information, but operating within this limitation may result in a walking speed so slow that it is inconvenient for him and for other pedestrians in his vicinity. Furthermore, navigational errors may still occur because of an insufficiency of information regardless of his walking speed.

As an individual's knowledge of a terrain increases through repeated contact with it he gradually acquires information about it, and this information is organized into a schema. This schema is abstract in character. The information represented in it is a selection from the potential supply of information about that terrain. The selection of information for inclusion in the schema is governed by the individual's needs, and these needs are determined by the nature of his

interactions with his environment. The functional significance of this schema is that it greatly reduces the amount of information about a terrain that must be obtained to interact with it successfully. Once the schema has been organized the individual can base his behavior on it, and he need only sample his environment for the feedback information required to keep the schema in proper registration with the terrain it represents.

Unless a given terrain is very similar to a previously experienced terrain, the blind pedestrian will not be able to obtain enough information about it during his initial contact with it to regulate his walking behavior adequately. It follows that, even if he stores all of this information, it will be insufficient to permit the organization of the kind of schema he would need to guide his walking behavior during a second contact with that terrain. He must typically follow a given path many times before he can organize the accurate and detailed schema he needs to traverse the path with comfort, speed, grace, and safety. Even when he has obtained this level of mastery, the schema representing the terrain in which he is interested will be an impoverished one, lacking much of the detail represented in the schema that can be organized with the information obtained by a sighted pedestrian after a single contact with this terrain. In fact, it is unlikely that the blind pedestrian will ever obtain the information needed to organize a schema as accurate and rich in detail as the sighted pedestrian's schema, regardless of the amount of his exposure. He will probably never know about the shapes of trees, buildings, and other objects; and his knowledge of their disposition will remain inaccurate and incomplete.

The sighted pedestrian's schemata unquestionably serve a valuable function, but if on some occasion he must move through an unfamiliar terrain, not represented in any of his schemata, the critical features of that terrain will be superabundantly specified by current stimulation, and he can easily obtain all of the information he needs to negotiate it successfully. He will need to devote more of his capacity for handling information to the task at hand than he would if he were in a familiar situation, and this capacity will therefore not be available for the processing required by concurrent tasks in which he might engage, but his behavior in coping with the terrain at hand will be precise and free from error.

The blind pedestrian's competence depends upon the adequacy of his schemata, and to achieve these schemata he must integrate information about the size, shape, and disposition of objects in the environment, their surface characteristics and other relevant features of structure that have been obtained piecemeal on many different occasions. The sighted pedestrian may not, as a result of a single exposure to an unfamiliar terrain, achieve a serviceable schema for use on subsequent occasions, but he does perceive its total structure at once. Consequently it is much easier for him to acquire accurate knowledge about its relational properties.

Once a serviceable schema has been achieved, its use is regulated by feedback information obtained during the expedition in progress. If this feedback information indicates that the schema is not in proper registration with the terrain it represents, the navigator must modify his behavior to restore proper registration. Consider the following example. A blind pedestrian is walking along a city sidewalk. He is on his way to work, and he is following a course that he has followed repeatedly in the past. As he walks along, the feel of the ground under his feet gives him information he can compare with information stored in his schema. This information might consist of observations of the following sort, "The surface of the walk has the feel of brick; at this instant, it dips to form a slight trough; immediately following it rises above the normal level of the walk to form a small mound; now the surface changes from brick to concrete and a moderate downward slope sets in." If these observations match the observations stored in his schema the blind pedestrian knows that he is on course. He may, of course, sense other stimulation from which he can obtain the information

that he is on course. Let us suppose that his course takes him by a building that is immediately adjacent to the sidewalk. As he passes the building, he recognizes the familiar feel of the warm, moist stream of air from the exhaust fan of the laundry inside. A little farther on he hears reflected sounds which inform him that a large object which he knows from previous examination to be a tree is to his left, on the strip of ground that separates the sidewalk from the street.

The stimulation so far discussed has served to inform the blind pedestrian that he is on course. However, it is quite likely that at some point in transit he will deviate from his intended course. When he does he may receive stimulation containing information that does not match any of the information stored in his schema. In this case he knows that he has departed from the course and that a correction must be made. To continue with the example, suppose that he has been walking for some time without any indication that he is off course. The surface underfoot is hard, smooth, and level, as it should be, and he experiences no unusual smells or sounds. Suddenly he is brought up short by abrupt contact with an object which he determines through rapid haptic examination to be a parked car. He now knows that he has departed from his intended course and that he must make a correction. Because of past experience he also knows that his error consisted of deviating slightly to the right, which caused him to enter the parking area of a filling station. This parking area is smoothly paved with concrete, and its surface is continuous with the surface of the sidewalk. As a result, he experienced no change in stimulation when he passed from the walk to the parking area. There may have been some auditory stimulation from which he could have obtained the information that he was abreast of the filling station, but the street to the left is filled with traffic at this time of day, and its noise masks the sounds that might have served as course indicators. However, because he has made this mistake before, he now analyzes the situation and knows what corrections to make. He turns to the left and walks until he feels with his feet the sloping apron of the filling station's driveway. He then turns to the right and follows this apron until the walk levels out again, and resumes his course along the sidewalk. The first time he passed this way he did not know about the filling station. On that occasion he also strayed to the right and ran into a parked car. This collision informed him that he had departed from his course and that a correction was required, but because he lacked prior relevant experience he did not know what correction to make.

There are a few important points to be gathered from the preceding example. During an expedition the blind pedestrian may obtain at least two kinds of feedback, or system-regulating information: information that tells him he is on course, and information that tells him he is off course. If he is off course, he may experience stimulation which informs him only that he is off course, or he may experience stimulation which also informs him about the correction required to bring him on course again. It follows that an adequate schema must represent more of the blind pedestrian's environment than the path he intends to follow. It must represent enough of the environment so that a departure from the path will not place him in a novel situation in which none of the stimulation he can experience is meaningful.

Since the blind pedestrian, unlike the sighted pedestrian, must depend upon his schema, his performance is influenced by factors that can interfere with the acquisition of schemata. These factors include imperfect stimulus registration, faulty perception, and forgetting.

According to the analysis just given, the blind pedestrian would have to depend heavily upon the learning that results from practice. He would perform poorly in unfamiliar situations, since he would lack schemata to which he could refer. Performance meeting the criteria of successful mobility would come only after repeated trials on a given course. Fortunately, this dependence is substantially reduced by the redundancy in man-made environments. In the typical cityscape, for instance, certain features

are repeated over and over again. On either side of the typical street, and running parallel to it, there is a sidewalk. This sidewalk is usually raised slightly above the level of the street. Frequently, but not always, there is a strip of unpaved earth between the sidewalk and the street. This strip is often planted in grass, and ranged along it one will generally find trees, utility poles, signposts, etc. The boundary between sidewalk and street is usually marked by an abrupt discontinuity in level--a step up or down. The center of the street is usually its point of highest elevation and it slopes downward on each side from the center to the gutter. Buildings are usually arranged in rows on each side of the street with the sidewalk interposed between buildings and street. In commercial areas there is generally no space between buildings, and they are usually immediately adjacent to the sidewalk. In residential areas the buildings are usually set back from the sidewalk and separated from each other. Many other repeated arrangements could easily be mentioned.

The significance of environmental redundancy for the blind pedestrian is that when he finds himself in a situation with which he has not had previous experience he nevertheless knows something about it. He brings with him into the new situation an abstract and generalized schema that is the averaged result of many particular schemata acquired in the course of his past experience. He can, therefore, estimate the probabilities associated with the various kinds of stimulation he might experience in the new situation. For instance, if he knows that he is in a commercial area he may also know that it is more likely that the street and sidewalk will not be on the same level than that they will be separated by a strip of unpaved earth.

The blind pedestrian's willingness to treat an expected state of nature as if it were an actual state of nature will depend not only upon his estimates of the relevant probabilities, but also upon his knowledge of the attendant risks and his willingness to take risks. Consider, for instance, a blind pedestrian walking along a sidewalk in a busy downtown area. There is so much traffic noise that he cannot learn much about his situation by listening. He must depend primarily upon his ability to obtain surface information. He wants to continue walking until he reaches the curb, and there to stop until he can collect the information upon which to base the decision to cross. However, he also knows that although the boundary between the street and sidewalk is almost always marked by a discontinuity in level, this feature is more apt to be missing at the intersections of downtown streets than at the intersections of residential streets. If he decides to act as if the expected state of nature were the actual state of nature the probability that he will not detect the boundary between street and sidewalk is small. However, if he does not detect it he may place himself in danger by walking into the stream of traffic. If he elects not to accept this risk, then he must consider alternative courses of action. He could remain immobile, in the hope that an attractive alternative not now apparent would soon develop. This would not be a wise choice because he can collect little or no information while inactive. He might avoid the problem by changing his course objective. He would probably seek assistance from another pedestrian in his vicinity.

So far, there has been little discussion of the role played by sensory aids such as a cane or an electronic device. These aids are useful to the extent that they enable their user to obtain additional information relevant to the task at hand. If this information is to be used to regulate ongoing behavior it must be acquired at a fast enough rate so that using it does not result in inconveniently slow performance. Sensory aids may be roughly classified as either clear-path indicators or environmental sensors. The clear-path indicator informs its user that the path ahead, the path along which he will walk if he maintains his present direction, is free from obstacles over the distance scanned by the device. It typically gives him no information about the nature of an obstacle, although by combining the knowledge of its presence with stored information acquired during previous expeditions, the nature of an object may often be ascertained. The conventional cane, the laser cane

under development at Bionic Instruments (Benjamin, 1967), and Russell's Pathsounder (1967), are examples of clear-path indicators. The principle advantage of the electronic clear-path indicators over the cane is that they extend the range within which obstacles may be detected.

The environmental sensor informs about a wider sector of the environment than just the path ahead. If it subtends a wide angle, and if the stimulation it displays contains information about distance and direction, its user can learn about the arrangement of objects, including himself, in the terrain to be negotiated. If the stimulation displayed by such a device also contains information about surfaces, the user's ability to identify objects by combining this information with stored information is greatly enhanced. The ideal environmental sensor would be one with a display so informative that its user could successfully negotiate a novel terrain on the basis of contemporaneous information. The visual system is such a sensor. At present, Kay's ultrasonic spectacles (1970) constitute the best example of an artificial environmental sensor. The device subtends a wide angle. Furthermore, since the device is head mounted, and since the head is well suited to the task of scanning, scanning efficiency is relatively high. Its signal contains some information about the surface characteristics of detected objects. Though experience with this device is as yet limited, it is likely that its use will enable blind pedestrians to strike a more favorable balance with respect to the mix of stored and contemporaneous information upon which they must rely.

A distinction between a clear-path indicator and an environmental sensor is an important one. With an effective environmental sensor the blind pedestrian can rapidly generate the schema he needs to choose between alternative paths, and hence to plot a course. If he must rely upon only a clear-path indicator, the schema he needs will be acquired only gradually, and it will be relatively impoverished in detail. If the blind pedestrian had to depend only upon what the clear-path indicator told him he would be destined to wander, safely but aimlessly, through an unstructured environment.

If the foregoing analysis of the mobility task presented in this paper is valid, its value lies in its ability to suggest questions which need to be answered to gain a better understanding of the mobility process. Increased explication of this process should in turn make it possible to devise more efficient training methods, construct better mobility aids, and evaluate mobility aids and skills more accurately. A conspicuous consequence of our neglect in constructing an adequate theory of mobility is the history of failure of devices that were intended by their inventors to enable competent and independent mobility. These devices have failed because we are not yet sure about what the blind pedestrian needs to know and how he should be told. Future devices are not likely to succeed until we have accomplished the perceptual research that can make us sure. As one illustration of this neglect, consider the following facts. If the blind pedestrian could be informed in sufficient detail about the surface characteristics of the terrain over which he walks, he would have almost all of the information he needs for safe and successful mobility. Yet, with the limited exception of the lowly cane, none of the mobility devices now available can give him this information. If the designers of these devices had considered more carefully what the blind pedestrian needs to know they would probably have designed different devices.

The analysis proposed in the preceding section raises many questions that should be amenable to experimental investigation. Several of these questions will be presented in the hope that they will suggest the general nature of the research program that is contemplated. Following this a few specific research problems will be outlined.

What information is obtained by the sighted pedestrian that is precisely relevant to the task of mobility? How much redundancy is there in the information he obtains and how useful is this redundancy? Does he depend exclusively upon the information present in visual

stimulation? If not, what other stimulation does he process and what is its relative importance? What features, and what relationships among features, are preserved in the sighted pedestrian's schema of a terrain? How many contacts with a terrain are required by the sighted pedestrian for the incorporation of a serviceable schema? Can a developmental pattern be discerned in the elaboration of a schema; that is, is there some selectivity with respect to the order in which the features, or the relationships among the features, of a terrain are incorporated into schema?

What information about a terrain is contained in the stimulation available to the blind pedestrian? What are the relative contributions of auditory, haptic, proprioceptive, and olfactory stimulation? What features, or relationships among features, are preserved in the blind pedestrian's schemata? How many contacts with a terrain are required by the blind pedestrian for the incorporation of a serviceable schema? What kinds of omissions and distortions are typical of the blind pedestrian's schemata, and how do his schemata compare with those of the sighted pedestrian in this regard? To what extent do blind and sighted pedestrians differ with respect to their dependence on schemata as they walk? How much do blind and sighted pedestrians differ with respect to the sufficiency of contemporaneous information for the negotiation of unfamiliar terrains? What are the differences between a schema constructed from information that is only serially available and a schema constructed from contemporaneously available information?

How do blind and sighted pedestrians compare with respect to their reliance on environmental redundancy in negotiating unfamiliar terrains? What differences are there among blind pedestrians with respect to their awareness of, and reliance upon, environmental redundancy? Do blind pedestrians estimate the probability of occurrence of various features in unexperienced terrains? If so, to what extent do they differentiate among probabilities? Are these estimates of probability taken into account by the blind pedestrians as they make the decisions that arise during their expeditions? Do blind pedestrians manifest differences in mobility that can be related to differences in the ability to estimate probabilities and willingness to take risks?

A sensory aid either increases the discriminability of stimulation already processed by the individual in his search for information, or supplements this stimulation with additional stimulation. If its role is supplementary, it provides stimulation that is either immediately useful because it is like stimulation the individual can presently interpret, or not useful without perceptual learning because it is unlike previously experienced stimulation. Which kind of sensory aid to build will depend upon answers to questions of the type suggested by this classification. To what extent will the blind pedestrian be assisted by increasing the discriminability of stimulation he is already processing? How much more of his environment can be specified by enriching the supply of stimulation that is interpretable without further learning? If significant features of the environment are to be specified by stimulation that is initially meaningless to the blind pedestrian, how much learning will be required before it can be processed at a useful rate?

Under some conditions the blind pedestrian may obtain information from self-generated, internal, proprioceptive stimulation. To illustrate, there is no information about the direction of objects in the stimulation produced by the Kay Sonic Aid, but because its beam subtends a fairly small angle it must be aimed at an object to detect it, and the aiming response of the person holding the Sonic Aid produces proprioceptive stimulation which contains directional information. How valuable is self-produced stimulation as a source of information in comparison to external stimulation, such as the stimulation produced by a sensory aid, and how useful might self-produced stimulation become with appropriate training?

Under normal observing conditions, as a sound source is moved closer to or farther from the observer, the change in the location

of that sound source appears to be directly perceived. The change appears to take place in the distal stimulus. The sound appears to move. Actually, of course, it is a change in the proximal stimulus that informs the listener about a change in the location of the sound source, but the inference about the change in location is unconscious and immediate. However, when estimates of the direction and the distance of an object are based on the sound produced by the Kay Sonic Aid, it is the proximal stimulus that is experienced. The observer consciously observes the characteristics of this proximal stimulus and consciously infers the probable cause of a stimulus so constituted. This process requires too much time to permit the collection of information at a fast enough rate to guide mobility at a normal walking speed. Can any training experience be devised that will bring about the perception of the distal stimulus instead of the proximal stimulus? Is this an instance in which training, if it is to be effective, must be undertaken at an early developmental stage in the life of the individual?

Precisely what information about the state of nature of interest to the blind pedestrian is present in the energy detected by a sensory aid? How much of this information is preserved in the display of the sensory aid? Is there any apparent information in the display of the sensory aid that is not present in the energy it detects? Could a computer be programmed to extract from the signal displayed by a sensory aid the information that the blind pedestrian is expected to obtain? The effort to achieve the kind of specificity suggested by these questions can be quite helpful in revealing crucial but unsuspected gaps in the knowledge prerequisite to the realization of a man-machine system that satisfies the requirements of mobility.

The questions just set forth are examples of the class of questions to be examined in the proposed program of mobility research. These questions are suggested by the rudimentary theory advanced in this paper. The results of the experiments they prompt should bear upon the adequacy of this theory, and should provide useful guidelines for the construction of training programs and mobility aids, and for the evaluation of both.

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THE BEAUTIFUL BLIND*

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INTRODUCTION

The summary below constitutes part of a larger manuscript which focuses on the role of work in affecting the self-image of "legally blind" young adults. Work serves many functions for the individual. It provides a source of subsistence; it enables us to structure time, giving order to our lives; it provides the individual with a source of identity; it affects one's social status and style of life; and it gives meaning and content to life.

The legally blind person in the San Francisco Bay Area is at a considerable disadvantage in finding gainful employment. The Bay Area labor market is highly unionized. Unions have been reluctant to accept the blind because they cannot always take normal promotions step by step and this compromises union policies of promotion by seniority. Some employers claim that their corporate insurance premiums will go up if they hire blind workers. Since it is mainly a center of commerce, San Francisco has very little heavy industry; thus the blind have to compete with the normally sighted where most of the jobs are--in service occupations. Here, normally sighted applicants are hired first; where they are not, other more vocal minority groups such as Blacks and Mexican-Americans are getting the jobs.

In the material that follows I have tried to assess how legally blind young adults who are not gainfully employed still maintain a positive self-image. Some employ psychological defense mechanisms; others find alternatives to work. We find that despite their dilemma in the job market, the vast majority of those studied have found some way to maintain a positive view of themselves. They did not conform to the stereotype of the downtrodden, self-pitying blind.

CHARACTERISTICS OF THE RESPONDENTS

Before proceeding further it is appropriate to detail some characteristics of the persons interviewed for this study. Without this knowledge it will be difficult to interpret any findings.

Age

The average age of the respondents was 28.9; the median age was 27.66. The youngest respondent was 18; the oldest was 54. As a group, those employed in private industry were the oldest (mean age of 34.89) followed in order by those employed in sheltered workshops (32.53), junior college students (25.64), state college students (25.55), and university students (24.25). The rather advanced age of the college students can be explained by a variety of factors. Legally blind students generally take a bit longer to complete their education than do normally sighted persons. Graduate students are included in the sample and this raises the mean age. Also, some students return to school after having worked for several years or after becoming adventitiously blinded. Others go to school after being unemployed for some time, often just as a means to have something to do.

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*This title indicating the somewhat elite character of the sample interviewed, was suggested by Miss Georgie Lee Abel, of San Francisco State College. The dissertation from which the following material is abstracted was originally entitled *The Legally Blind Young Adult*, and was submitted in partial fulfillment of the requirements for the Ph.D. degree at the University of California, Berkeley, in March 1970.

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Sex

There are over twice as many men as women in our sample. Men significantly outnumber women at all work status levels, except among the university students where there is a significant concentration of women.

Table 1

Age at the Onset of Blindness by Sex of the Respondent

Sex	Congenital	Adventitious	Total
Male	24	29	53
Female	13	12	25
Totals	37	41	78

Sex is significant when the etiology of blindness and timing of the onset of blindness are considered. Table 2 shows how these three variables interrelate.

Etiology of Blindness

Among the 73 respondents about which we have some information on all three variables, 37 were congenitally blind and 36 were adventitiously blinded, a very even split indeed. Among the adventitiously blinded, all but 12 respondents were aware of a loss of vision after the age of 5. Eight males and 4 females reported significant loss of vision between the ages of 1 and 5.

Although we found no appreciable tendency toward congenital or adventitious blindness among the men and women in our sample, we would expect that in a larger sample we would find a greater number of adventitiously blinded men because of their greater likelihood of becoming blind through accidents. This likelihood is enhanced by a cultural expectation that men should be active and daring and women should be more docile and serene. Among the adventitiously blinded, accident was the most frequently mentioned cause of blindness. Often the accident would lead to the development of cataracts which caused blindness. Accidents were much more prevalent among our male respondents than they were among our female respondents.

The rather large numbers of "other" causes of blindness among the adventitiously blinded are mostly from either retinitis pigmentosa[1] or from retinal detachment. Retinal deterioration or detachment was more prevalent among men.

Table 2

Cause of Blindness by Congenital or Adventitious Blindness and Sex

Cause	Male		Female	
	Congenital	Adventitious	Congenital	Adventitious
Glaucoma	1	1	1	1
Cataracts	4	0	2	1
Accident	0	10	0	2
Retrolental fibroplasia	5	0	4	0
Diabetes	0	4	0	1
Unspecified congenital	10	0	3	0
Measles	1	1	2	0
Other	3	11	1	7
Total	24	27	13	12

Many of the congenitally blind respondents apparently did not know the exact cause of their blindness or did not reveal it. There were 13 respondents just saying that their blindness was congenital. Part of the reason why there is not more detailed information on this question is that this question occurred very early in the interview schedule, and it was felt that deep probing this early would be poor strategy. Thus, when a respondent offered that he was just born blind or didn't know what caused his blindness, the matter was dropped.

We expected to find a significant number of retrolental fibroplasia victims because of the age of these respondents. They were born at a time when this condition was at a peak. Retrolental fibroplasia claimed an almost equal number of male and female respondents and was the cause of blindness for over 11 percent of our sample.

Race

Our sample was primarily, but not exclusively, Caucasian. We interviewed 58 Caucasians, 8 Negroes, 6 Orientals, and 6 others who could not be readily identified with any racial group. The Caucasians were almost equally divided between those congenitally and adventitiously blinded. The Negroes and Orientals both shared a greater incidence of adventitious blindness.

Table 3

Congenital or Adventitious Blindness by Race

	Congenital	Adventitious
Caucasian	30	28
Negro	2	6
Oriental	2	4
Other	3	3

IQ

Two subtests of the Wechsler IQ test (WAIS) were administered to as many respondents as would take them. The two subtests chosen were the vocabulary test and the digit-span test. These two were particularly adaptable for the administration to the blind and were good for our particular interview situation because they were short. Because interviews lasted about two hours, the IQ test could not occupy very much of that time if I were to learn about blindness. These two subtests were ideal in that they required no vision. They could be given orally.

The vocabulary subtest consisted of supplying the meaning of forty words. The person administering the exam assigned either two, one, or no points for the definition which the respondent supplied. The score was an evaluation of the preciseness of the definition. Examples were given to the administrator in a test booklet so that he could determine the appropriate point value of each answer he received. The highest possible score on this subtest was 80.

In the digit-span test, the person administering the test began with a three-digit number. When he finished saying the three digits, the respondent was to repeat the numbers as they were read. If he did this correctly, the person administering the exam read four digits. A correct recall by the respondent would increase the next digit reading to five digits. This continued until a maximum of nine digits could be recalled. This test was followed by another digit-span test where the respondent was asked to reverse the order of the digits as read to him. As each correct recall was made, again another digit was added until the respondent showed an ability to reverse perfectly the order of eight digits. The digit-span test was ended both forward and backward when the subject missed two consecutive trials at any given number of digits. The results of these tests are revealed in Table 4.

Performance on the vocabulary test seemed to correlate rather directly with level of education. The students align themselves in levels. Obviously all junior college students have had some college experience, which is not true of the private industry workers. But the private industry workers exhibit

Table 4

Number of Persons Taking the Vocabulary and Digit-Span Subtests of the Wechsler IQ Test and the Mean Scores Obtained on These Tests by Type of Employment

	University Students	State College Students	Junior College Students	Private Industry Workers	Sheltered Workshop Workers
Number of persons taking vocabulary test	12	15	12	17	10
Mean score on vocabulary test	66.83	59.80	55.42	54.50	37.70
Number of persons taking digit span	11	15	12	19	12
Mean score forward	8.09	7.27	7.25	7.47	6.83
Mean score backward	6.82	6.27	4.92	6.31	4.83

greater exposure to formal education than do the sheltered shop workers, several of whom have not been to high school. Rather than the test score accounting for the relative academic performance of the groups, the scores probably reflect exposure to learning vocabulary words. The more exposure by means of formal education, the better the performance. Thus, it is likely that level of education is an independent variable accounting for the vocabulary test scores.

Another possibility, particularly differentiating junior college students from private industry workers, is the temporal proximity of schooling. Several junior college students had recently taken English courses where they had exposure to a variety of words and recently had the experience of being tested, so that they realized the importance of precision. The fact that the private industry workers probably had not been exposed to this kind of test for a long time might have put them at some relative disadvantage.

No such disadvantage existed in the digit-span tests, however. These tests hold level of education relatively constant because they are designed to measure sequential memory. The greater neutrality of this subtest improved the performance of private industry workers. The university students again outperformed all other groups. The private industry workers, state college students, junior college students, and sheltered shop workers followed respectively in their level of performance on the digit-span test.

Our cursory testing lends some justification for the sheltered shop workers being where they are. On both tests respondents working in sheltered workshops collectively scored lower than any of the other groups. They were much lower on the vocabulary test, and on the digit span they did not demonstrate sufficient recall ability to remember a telephone number. Environmental factors partially account for their low performance on the vocabulary test. Many of these respondents came from homes where English was a second language, if it was spoken at all. The intellectually unstimulating environment of their work setting also might account for some gap in their performance on the vocabulary test. These factors, however, do not help us in understanding their relatively poor recall on the digit-span test of memory.

With this brief introduction to the people who were interviewed, we turn now to their dilemma.

THE REFUSED

There is a distinction to be made between those blind respondents who are in training for jobs and those who have finished some training and have experienced the hardship of trying to market their skills. This section focuses on those who have been rebuffed in the job market. The central question is how they maintain a positive self-image in the face of these rebuffs.

Some of those who have been refused employment look upon the students as naive. They say that students think they are on top of the world now, but when they get out in the world outside, where they are not in a sheltered environment, they will come face to face with a new reality, a reality of denial. The students find this hard to believe and belittle their peers who are either not working or working in a stereotypic job like mop and broom-making. In this respect there is some friction between some students and unemployed or sheltered shop blind.

Having examined some of the adaptations of the students who are training for jobs, it is now appropriate to examine how those who underwent training and then were refused employment adapted to this denial. We will examine five adaptive factors which were evident: redemption through victimage, the sheltered workshop, a return to school, political activism, and the peer group. All of these paths serve to bolster the ego of the blind in the face of the negative sanctions which he receives in his environment. They account for the blind person's ability to maintain a basically positive self-image.

REDEMPTION THROUGH VICTIMAGE

The world is never what we would like it to be. There are always problems and evils with which we must contend. With man having some measure of mastery over his environment, we must assume that somebody is responsible for the fact that things are not as they should be.

It is a basic premise of social psychology that man cannot live with a basically negative self-image. He cannot consider himself a basically evil person. The feeling of guilt is a manifestation of our feeling responsible for creating evil in the world. We feel guilty when we are responsible for acts which have harmful or undesirable consequences. Responsibility for evil acts reverts back to an adverse definition of ourselves; if we are responsible for evil, we are evil.

Because it is extremely difficult for man to live with guilt, he devises techniques which will reduce or eliminate it. One such technique is redemption through victimage.[2]

We redeem or cleanse ourselves by victimizing others, or holding others responsible for the evil in the world. The Vietnamese War is a recognized evil. We cannot hold ourselves responsible for it. If we did, we would hold ourselves to be evil. So we call it the responsibility of the communists. It is their fault. If they weren't there, there would be no war. We recognize rioting in our cities to be evil, an evil which is not our responsibility but the responsibility of the blacks in our society. We thus cleanse ourselves through the victimization of others. Rioting on college campuses and the unrest among America's youth is considered by many to be evil, yet it is an evil for which we are not responsible; it is the communists "within" who are to blame.

For the blind, the evil in the world is that they cannot find jobs. They cannot hold themselves responsible, for this would involve viewing themselves as worthless, helpless, or incompetent. Many respondents redeem themselves by victimizing their state vocational rehabilitation counselor. They blame their unemployment or the fact that they do not have a better job on the inefficiency of their counselor rather than on any deficiencies or lack of initiative which they possess.

This victimization is facilitated by conflicting interpretations of the role of the vocational

rehabilitation counselor. The clients view their counselor not as a counselor at all, but as a job placement director. Given this view, they expect their counselor to find them jobs. Unfortunately, the counselor does not share this view of his role. He perceives his role as a counselor and expects his clients to go out and find their own jobs. One counselor describes his perception of his role as follows:

> "[Just what do you see as the role or the job of the rehab counselor?] . . . kind of each counselor has his own view right now. Our department is in the throes of answering this question for itself. The 'traditional' view is placement orientation. You go out and beat the bushes four days out of five, and you come in and talk to the client and find out what the client would like to do, and you go out and find it for him. Because we are moving into work with more severely disabled people, this is less possible than it was. The traditionalist could not consider accepting some of the people we have accepted just recently. He simply couldn't do it. We have still got a few traditionalists around, and I have heard them say at times to clients, 'If you are not able to go out and work tomorrow, I am sorry we can't help you. And if you are not ready to go out and be trained tomorrow, I can't help you.' On the other hand, I feel very strongly that nobody can place the client better than he can place himself. Ideally, if you have done your homework well and provided good training and spent some time in counseling as to placement approaches and so forth, you know the client can go out and get his own job. In practice, obviously this doesn't happen."

> "Our 'best clients,' the ones who have this kind of moxie I was talking about, they go get their jobs. We may give some guides, you know, suggestions. We may go in as a back-up to try and alleviate the employer's fears about hiring blind people by talking about what our experience is with blind people. But this group of people is not much of a problem. Where your problems are, are your people with minimal skills, minimal sophistication. And this I want to be sure that you are aware of, the distinction between this and cooperation. When you talk about a lack of cooperation, this is a very different matter. You see, I have to be sold initially on a person before I can go sell him. And if the person sits there and says, 'uh, I want you to go get me a job,' I am not really convinced that they are independent enough to handle a job. And I find it difficult enough to go and hit up the employers in their behalf. Throw that man--the client who doesn't cooperate--out. I am talking about the person who maybe goes in waving his cane, or maybe goes to the employer and says not directly but indirectly by attitude, 'you owe me a job.' These are the people that you have to go out and place, because approaching employers that way is not going to get them a job. I am merely saying that our clients are giving the message back to you that we have either said, or they think, that we are going to get them a job, or that we are going to place them one by one. I try to convey the idea that it is going to be a joint effort; that I will do what I can. I will open the doors that I can; I will make the employer contact. This is part of our job. But I will not take him by the hand and take him to a job."

The incongruity in expectations leads to dissatisfaction among the rehabilitation department's clientele. This dissatisfaction is expressed as follows:

> "Rehabilitation offers nothing; they offer nothing but lip service. . . . A lot of money is wasted in just plain counseling. . . . If you come up with a plan, maybe they will agree with it and maybe they won't; nine times out of ten they won't. . . . They have the answers; they know it all; they can tell you this and they can tell you that. They only spend their time counseling, but that doesn't give a person a paycheck, and it doesn't give

them training. . . . It is better to train fifty people properly than to counsel a thousand and do no good."

"It is very easy to be embittered against rehab. Like I am sure you have heard blind people say of that fucking rehab, 'They don't do anything for me.' It is so easy for a blind person to become embittered. The rehab worker, as we have talked about before, can sit in his office, and he knows that people who are blind have to come to him and have to ask for his services. Well, when you ask for something, you have to put yourself in position of negotiation with the man and it can't help but embitter you a little bit or else make you feel like you have been refused for personal reasons. Whatever it is, we have got to find a different way, a different relationship between client and workers. It is just not working this way. . . . Don't give us welfare. Don't support us. Give us something constructive to do and I think that we have a mentality to do, but convince the people in control of that."

"I feel that rehab doesn't understand some of the basic needs of the individual person. I feel that there are a lot of desk workers and that's about it. Yet I do agree with their helping a person in school. They are fine when a man is in school, but after he is out of school or is working here, they just don't seem to be on the ball."

". . . in the beginning of rehab they did a lot of leg work, as you put it, and now they are doing less and less of it. Go to school is about the only thing they want you to do. They don't mind spending ten thousand dollars in putting you through college, but they don't want to spend five thousand dollars training a person for a vocation."

By blaming his rehabilitation counselor for not getting him a decent job, the client defends himself from the fact that he may not have the mobility to look for jobs or may not have the skills to qualify for many jobs, or may not have the ego defenses to cope with consistent denial. He transfers his own incapacities to the counselor. In this way he is not responsible for his unemployment; his counselor is. He thus constructs a rationalization for his unemployment by which he cleanses himself from blame by imposing blame on others. This is redemption through victimage par excellence.

THE SHELTERED WORKSHOP

One way of adapting to the continual denials which the blind encounter in the labor market is to go into a sheltered workshop. An example of how redemption through victimage operates is found in the way that sheltered shop workers complain that they are in sheltered workshops rather than in private industry. They complain that their counselors do not understand them. They complain that their counselors are trapping them in terminal employment rather than constantly looking for better jobs for them.

"There is a terrible frustration of trying to find a job."

"I had to do something, so I had to come back [to California Industries for the Blind]. So it boils down to one thing. We are not here because we choose to be. It is a means to an end. There wasn't anything else; either that or sit at home and sulk and feel sorry."

Out of this frustration comes a desperate need to work, to prove that one has the ability to earn a paycheck. So some people condescend to work in a sheltered workshop for the blind. Most people go in expecting this to be temporary employment--temporary until they find something better "on the outside."

There is a marginality inherent in sheltered shop employment. On the one hand, it has many of the advantages which employment has over unemployment--it structures one's life; it is a source of identity; it is a source of money; it provides a setting for socializing; it alleviates the boredom of idleness; it brings one status which is one notch

above the unemployed. On the other hand, the job does have extremely low prestige. The sheltered shop is recognized as a place for those who are incapable of or who cannot find employment on the outside. This adversely defines those who work within these institutions, both in the minds of others and in the minds of the workers themselves.

As we have observed, one way of redeeming oneself from this stigma of the sheltered shop is to blame one's presence there on the inadequacies of the rehabilitation department rather than on one's own inadequacies. This is redemption through victimage.

However, not all sheltered shop workers employ this technique. And not all sheltered shop workers are temporary trainees in the sheltered shop system. When one does not exonerate oneself for prolonged service in these institutions, it leads to self-hate and an adoption of a negative self-image. The testimony of the following respondent is a case in point. He has been making mops and brooms for 19 years. He blames himself, not his rehabilitation counselor, for this.

> "I have been making brooms now for 19 years, and I still cannot understand it, because I am interested in other things. This has really been the worst thing that I have ever done in my life, this making brooms, and I hate it with all my being. But for some reason or other--of course, I probably have an inferiority complex--but I just can't get away from it. I just keep going. There is always something; I can't get away from it. I just keep going. There is always something that I want and, of course, I have to keep busy and everything, and I haven't got the schooling that I should have had, but, in other words, I don't like my job. I think very, very little of my job, but I think even less of myself, if you want the truth, because it is my fault that I am making brooms. It is my fault because, you know, it is quite a problem. I just don't know exactly how to go about it, to make a change. I want to make a change, but apparently I am too weak to do so."

The self-hate which results from not invoking redemption through victimage makes one realize that, if nothing else, rehabilitation counselors are performing a valuable function as scapegoats: *they are preserving the egos of their clients.* If they performed their jobs more efficiently or became good job placement directors, they would cease to perform this valuable function.

RETURN TO SCHOOL

Not all respondents when they fail to find jobs go into sheltered shop work. Some retreat to the relatively accepting environment of a college or university. They return to school. Unlike factories or corporations, colleges or universities, particularly state colleges or universities, will accept all applicants who demonstrate the willingness and ability to benefit from the school's offerings. Unlike factories or corporations, admission is not based upon race, religion, or physical disability. Regardless of one's age, colleges and universities are open to perform many of the functions for the individual which would have been performed through work had work been found.

Going to school, though temporary, provides the student with a positive source of identity. To be able to tell others that one is attending a college or university for a bachelor's or master's degree carries much more prestige than telling others that one is currently unemployed and looking for a job. Of course, after obtaining his degree, the respondent will be in exactly the same place he was in when he returned to school--unemployed--but at least going back to school postpones this for a while.

What is postponed is the boredom of unemployment, the boredom of having nothing to do. The syndrome is explained by one respondent as follows:

> "Blind people, since they don't have to work because of state

aid, that automatically eliminates a choice for them; welfare is there, medical cards for dental work, all kinds of doctor bills are paid; that is all available. It's not necessary to work. But then if they don't go to school, then they are burdened with one of the biggest problems that I think exists: what the hell to do with yourself, how to exist, how to keep occupied and keep busy. That is why I think so many of the friends I have that are blind--and I include myself in this--are somewhat neurotic, because they just don't have enough to occupy themselves. . . . _____ is going to graduate school now, and she is going to school for one reason: because if she didn't go to school right now, she wouldn't have anything to do. So she is still in school. . . . Now you can go to school and get a degree; you can get a BA and go out and get a job. I can't do that. I can say that, and I can back it up with facts. I am sure that you are aware of that, that blind people are not as easily employable, so if you are not as employable, if you don't have the facility to work, then you have got to structure your life differently; you have got to have something to do or you will flip out. So some people turn to Western music, sitting at home with their fingers in their eyes, rubbing back and forth; some people go down to the Opal Street Center and make canes; some people stay in school. . . ."

The irony here is that some respondents return to school after it has already failed for them once. They went to college for the first time because they were told that they needed a college education if they were to qualify for good jobs. Some got degrees, could not find jobs, and so went back to school again for another degree. Some go back to school not so much for degrees as for vocational training in specialized areas. Three of our respondents were returning to school to go into computer programming after unsuccessful attempts to find jobs in other areas.

Despite the variations in reasons for going back to school, this is a frequently used adaptation to unemployment. About one-fourth of our college students are going to school after unsuccessfully trying to find good jobs. The nature of the lives from which they are escaping is depicted in the testimonies which follow:

"When I was by myself, I would just sit around and vegetate and mope. I might do things like hear the radio and not just hear music but hear some talk programs too, but in the great sense, I was a moper and sort of a solitary person. I could communicate and be articulate, but my basic attitude was one of moping."

"[Why do you want to go to college now?]. . . It is almost a necessity for handicapped people to have an education. . . it keeps me active for one thing. If I don't go to school I will just lay around."

Sleep is a common escape from boredom. When people have nothing better to do they will sleep. It is common to hear people comment that they get very tired early in the evening on weekdays, yet when they go out to a social function they can stay awake to the wee hours of the morning. Being tired from hard work and being tired because one is bored are two distinctly different types of weariness.

Students are very prone to tiredness from boredom. Directors of student health centers on college campuses testify that from coast to coast the most common complaint is: "I'm tired all the time--you'd better test me for mononucleosis." In the majority of cases no physiological cause of the symptoms is found. Two explanations have been offered by the student health service directors to account for student tiredness. One is that it is caused by the high level of tension and anxiety which is engendered on college campuses. The other explanation is that students are tired because they are bored. The school only structures about 20 hours a week of their time.

This is minimal compared to the hours per week which are structured for the average full time

employee. Yet it is twenty hours per week more structured time than the unemployed worker receives. The life of a student is more appealing than the life of an idle worker. Though the student has boredom because he does not know how to use his free time effectively, this problem seems minor compared to that of the unemployed worker. And so the unemployed blind person enters the greener pastures of whatever institution of higher learning will accept him. It is one way out of his dilemma.

POLITICAL ACTIVISM

Like many other groups of people with stigmas--ex-convicts, ex-mental patients, members of racial and ethnic minorities, the elderly, people with other physical handicaps--the blind are marginal people in our society. They are marginal because they are not fully integrated within the fabric of society. Very much like the elderly, many blind people have found political activism to be a rewarding mechanism through which they become more integrated into the social structure. Where many senior citizen groups have recently become extremely vocal in lobbying for and proposing legislation which meets their needs, so also many of our blind respondents have centered their interests in politics. Some have become involved in labor union politics; others are members of special interest groups which lobby for legislation having relevance to the blind.

Some sheltered shop workers were active participants in a local labor union. Just after the interviews for this study were completed, the union struck against California Industries for the Blind over allegedly low wages. Workers were paid a piece-based rate. That is they were paid per unit produced rather than an hourly wage. On this basis some workers earned a relatively good hourly wage, but others were not so fortunate. The grievances were passionately expressed by a union member as follows:

> "CIB [California Industries for the Blind] is the most demoralizing place in the world. . . . It is demoralizing; it breaks down a person's morale. As far as rehab, it is a terminal point, terminal. Now they are trying to do something and they don't even know what they are doing. They are doing it, these sighted people who don't know what they are doing. . . they don't have the experience or the know-how. They don't even know about blindness and yet they are drawing a high rate of pay, and how do you think that demoralizes a blind person, to be told what to do by some stupid idiot like that. . . . You know the big boss that came up and introduced you to me. I look at him with a feeling, son of a bitch. Then we turn around and I go right in there on negotiations, four of us. We practically call each other sons of bitches. And we can see how the man is lying. We can see his attitude. Do you know what his attitude is? Nobody there is worth $1.40 an hour. I said, 'You idiot, any person is worth $1.50 an hour if they just sat there and looked stupid.' And I said, 'If you go that way, how about you civil service persons? We are paying your salary of $1200 a month on hard sweat, and you are telling us something you don't even know. We are helping you to administer the Goddamn place.' He don't dare fire me. He has tried. I could care less; the day he fires me, I will knock him on his can. . . . But I will beat him politically, up above him. . . . I told you this is terminal as far as rehab is concerned. This is b.s. about this training set-up. It is a joke, a farce. The only thing they are doing is to derive federal money into the state department of rehabilitation. That is the big kick. It is a subsidy they are getting from the federal government under the poverty program. . . . It may not help us too much, but maybe in the future, other people won't have to live like this. Any human being should be able to go out and make a decent living."

The reason that this confrontation between labor and management became so embittered was that the low wages which the workers

received were taken as an index of their worth in the eyes of others. These blind workers were fighting the same battle with the State of California (which finances CIB) that they had formerly lost and which had put them in a sheltered workshop. They had to convince the State that their efforts were worth greater recognition; the State had to be made to recognize what private employers would not--that the man who was blind could still function as a productive, reliable, competent employee. In the battle over wages the blind were also fighting a battle over public recognition of their worth. Their self-image was at the heart of the issue.

Unions are not the only areas for political activism among the blind. There is greater representation among our respondents in special interest groups for the blind. These groups are divided along lines of two diametrically opposed orientations to blindness. One orientation is geared to increasing state aid and other welfare benefits to the blind. They advocate the creation of more jobs for the blind even if they have to be jobs which are set aside especially for the blind. This orientation would enthusiastically welcome the strengthening of vocational rehabilitation services.

The other orientation de-emphasizes the special character of legally blind people. Its supporters can perhaps be labeled assimilationists. They want to be integrated into the sighted world and accepted as equals, rather than being categorized in a special class which is differentially treated. As one respondent explains,

> ". . . A blind adult who is capable should try his best to assimilate himself into the sighted world. . . trying to bring about legislation, bring about this amalgamation, this assimilation by advocating that certain types of statutes should be dropped or be put on the books so as to make the handicapped, the disabled adult come into the sighted world. . . to help the blind live effectively with the sighted in terms of goals, in terms of careers, because there are many occupations where the blind are not hired."

Advocates of this orientation don't want special favors and don't want welfare; they want a fair chance to lead the same kind of life as normally sighted people do; they want a fair chance to earn a comfortable living; they want a fair chance to show others their capabilities and limitations rather than having these prejudged.

These philosophical orientations are not unique to the blind. They certainly also exist in the black population of this country. The difference between the blind and the blacks is that among the blind it is considered to be radical and left-wing to be an assimilationist, while among the blacks, this orientation is conservative and right-wing. The assimilationist doctrine among the blind is most popular among the youth, while separatism in the form of "black pride" is most popular among black youth.

Blind assimilationists want a status in society equal to that of the normally sighted. This comes about through a proof that blind and sighted people are roughly equal in their ability to be creative, productive, and amiable. It involves an elimination of the stigma of blindness; it involves the normally sighted person perceiving the blind not as blind men but as men. The view is a mirror image of the Reverend Martin Luther King's.

Regardless of how the separatist-assimilationist question is structured within a stigmatized group, the question does seem to exist. Among former drug abusers there is the problem of becoming reintegrated into the fabric of society through gainful employment on their own--which is very difficult because of their stigmatizing past--or reintegrating artificially through employment in special industries and business enterprises which are run by Synanon. The latter approach creates the same marginality as we found among our sheltered shop workers; one is earning a living, but it is not very ego boosting, because in the back of the worker's mind is the knowledge that he is working

there because he would be rejected "outside."

The same problems of occupational integration exist for ex-convicts, ex-mental patients, the elderly, and people with all kinds of physical handicaps. As a result, questions pertaining to the establishment of sheltered work settings arise as do issues of special social welfare considerations for these groups. Inevitably, members of these groups begin to polarize on the issues of segregation vs. assimilation and become politically motivated to support key action programs. Among the blind this polarization is very evident.

This political activism serves many of the same functions for the individual as does work. It provides a source of interest around which one can devote one's activity; political meetings occupy and structure one's time; it is a source of making social contacts, and it is a source of personal identity.

THE PEER GROUP

If a member of a minority group cannot eliminate the status differential which exists between himself and members of the majority group, he can at least seek out situations where the burden of his stigma is reduced. He can avoid situations where he experiences prejudice and discrimination. This avoidance can take at least two possible forms: he can disassociate himself from other minority group members and try to "pass" as a member of the majority; or he can immerse himself in groups of other minority group members.[3] These groups constitute for the individuals within them a more benevolent environment than exists "outside." These groups further provide the individual with a dignity and a sense of belonging which is difficult to experience elsewhere.

Of these two avoidance patterns the latter is more readily observed among the totally blind. Passing is more common among those with more acute vision. It should be noted that among those interviewed, "passing" was rarely a permanent state of affairs. Passing was much more situationally specific. A respondent would decide in a given setting whether identifying himself as blind would be more beneficial or more harmful to his interests and would act on the indication he made to himself. The likelihood is that sampling affects the nature of these observations in that I would have no access to the people who by definition were legally blind, but who were permanently passing as normally sighted persons. I only had access to people who at some point identified themselves as blind.

Those who did identify themselves as blind were often part of some social group which was composed of blind persons. The blind peer group functions to support the individual psychologically. It serves as a buffer between the individual and the negative definitions of his stigma which are imposed by the social order.

Among 64 of our respondents answering the question, "How many of your five best friends are blind?", over half claimed at least one of their five best friends to be blind. Twelve respondents claimed three or more of their five best friends to be blind. When we consider that there are perhaps two or three blind people per 1,000 of the general population, the social network among the blind appears much more tightly structured than we would expect to occur by chance. If we were to ask normally sighted people the same question we would certainly be surprised if anywhere near half of them claimed at least one of their five best friends to be blind. How can we account for this close pattern of association among the blind?

This is partly institutionalized within the social structure. When most of our respondents went to grammar school, there was a special school for the blind in Berkeley where they were segregated from normally sighted students. They studied, ate, and slept at this school and thus built rather lasting friendships which endured through high school and college.

In many high schools and colleges there are special rooms set

aside where the blind can study. These rooms are needed because the process of reading aloud or listening to tapes would disrupt a normal, quiet study setting. The isolation of a special room for the blind serves to foster social interaction among the blind. They are given a common setting for interaction. Without this setting they might never meet in a large school.

There is a feeling among the normally sighted that blind people should meet, that they would enjoy each other's company. There is a compulsion to get blind people together. This is reflected in various social, charitable, and service agencies for the blind. The East Bay Center for the Blind, the Opal Street Center for the Blind, and the Lighthouse for the Blind all result in segregated recreation for the blind. Various sheltered shop programs such as Lighthouse for the Blind, California Industries for the Blind, and Opportunity Work Center results in segregated work for the blind.

The belief that blind people should be together results in an increased likelihood that the blind will be grouped together. The resulting contacts frequently end in friendships which are functional for the blind. *But the basis of these friendships is often in terms of a shared revolt against the very institutionalized groupings of the blind which brought these people together.* College students who are graduates of the California School for the Blind are often very close from this shared school experience, yet part of the bond that binds them is a shared belief that the blind should not be segregated and should receive public schooling with normally sighted children.

Friendships made at social centers frequently have as their basis a shared hatred of these centers. The two testimonies which are quoted below constitute typical reactions to the do-goodism of the normally sighted in trying to get the blind together. Certainly part of the problem is that the blind are all treated alike. But an even more serious complaint is that this service is, as it is called, ". . . for the blind." It is given in the spirit of charity and sympathy and is thus degrading to its recipients. The blind make a crucial distinction between organizations *for* the blind and organizations *of* the blind. Organizations of the blind are administered by the blind for themselves. Organizations for the blind are held suspect for the reasons which are revealed below.

> "I don't particularly like the group activities. . . . If you go for the provided type of thing, then what do you get? You are all leveled out. You are all blind, and that means that the titsy ladies come in and, well, how are you this morning? Are you enjoying yourself? We are going to have a lunch today and we are going to have this and that. And then after lunch, did you enjoy your lunch? Oh, for Christ's sake, it is a miserable type thing! You are downgraded. You are all put in the same boat. There is no difference made between one blind person and another; you are all the same in the eyes of these do-gooders. It is a degrade that is even more degrading than the shop."

> "Now as far as I am concerned, I don't attend Adult Blind Center, Lighthouse for the Blind here in San Francisco, and my reason is that when I walk into that place, it gives me the odd feeling that I'm walking into a decrepit situation where I feel that I'm being stereotyped, being manipulated mentally. I just get that odd feeling, that's all. This aging problem, that gets me too. I walk in there and I feel that I'm about 15 years older. When I walked in there, this woman approached me. She's one of the workers there, sighted, and says, Mr. _____, would you like to stay for lunch? You know. Da, da, da, this and that, and it makes me feel 10 or 15 years older. I don't know what it is. I just get that emotional feeling about it."

Several observations about friendships among the blind are in order here. In colleges and universities segregated study space tends to foster the association of blind

with blind. This is consistent with a cultural orientation toward homogamy--blacks should be with blacks, Chicanos should be with Chicanos, lower class should be with lower class, and blind should be with blind--and this is why the melting pot conceptualization of our country is a myth.

Friendships among the blind frequently have a political base. The shared activities are often political activities.

Some respondents assess their worth by their ratio of blind to sighted friends. The more sighted friends they have, the higher is their self-esteem. They are very blunt in saying that friendship, like marriage, is based on an exchange principle. People are friends if each has something to offer the other that the other needs or likes. Where the exchange ceases and the relationship is all give or all take the friendship ends. Having sighted friends shows the respondent that he still has enough to give the normally sighted to merit their friendship. This is ego boosting just as the reverse situation is ego deflating. This indeed reflects an internalization of public stereotypes that the blind are inferior to the normally sighted.

Yet friendships among the blind are very strong and serve several vital functions. Through the commonality of shared experiences one realizes that his problems are not unique but are shared by others with his stigma. This shifts blame for problems which he encounters from himself to the intolerance of the social structure. Furthermore, the existence of friends means that he need not endure the frustrations and inconveniences of blindness alone, but can have a sympathetic and understanding friend with whom he can share these difficulties.

Last, having friends who are blind is functional from an informational perspective. There are many inconveniences which the blind encounter which sometimes have some surprisingly easy antidotes. A blind person, having experienced and perhaps overcome this inconvenience, is apt to be a more helpful resource than a normally sighted person who has never considered the inconvenience. In this respect the blind help one another adjust to the many small problems of everyday life. The overcoming of these problems is a further boost to one's ego.

THE EMPLOYED

One should not get the impression that all of our respondents were continuously denied employment. In fact, 21 were gainfully employed in some job outside of a sheltered workshop setting at the time of the interview. Among these respondents, 6 worked as x-ray developers in hospitals, 5 worked as clerical transcribers (4 of them as medical transcribers in hospitals), 3 worked in the state and federal government's joint Business Enterprise Program as snack bar operators, 1 worked as a switchboard operator, 2 did assembly work, 1 was an auto mechanic, 1 was a paint mixer, 1 was a musician, and 1 was a professional photographer.

There is no question that among these vocations the Business Enterprise Program work was most lucrative. One respondent, who is the manager of a snack bar in San Francisco, nets approximately $30,000 annually. Of course, not all people in this program make that much. There is a competitive struggle for lucrative places in public buildings, and this one respondent has a better setting than most. He exhibited great personal pride in his selection for this position and for his ability to make such a success out of it. He boasts that "I have been there three years this August and it is in the top three or four in the state."

Other respondents who are gainfully employed also take pride in their work and use this to bolster their ego. Yet each respondent has some factor which makes his job less than fully rewarding and self-fulfilling. Very few respondents found their jobs on their own, for instance. The majority of respondents were introduced to their position with a call from their vocational rehabilitation counselor.[4] They were asked if they wanted the job which he had available. For the

most part, most of these clients had never considered working in the post which the counselor offered.

The serendipity involved in landing these jobs deprives the client of the joy of saying that he got the job on his own. The few respondents who did find jobs on their own took great pride in this fact.

> "I did this myself. I went to hospitals myself. I wrote letters. I wrote a form letter and copied the same letter over again and sent this out to different hospitals. . . . Then I surprised them when I went to Children's Hospital. [Why did you write and do all this yourself?] They were too slow and didn't try a lot."

There is an interesting dilemma for the vocational rehabilitation counselor here. If he does not find jobs for his clients, he is doing wrong. If he does find them jobs, he does wrong because he deprives his clients of the pride that comes with finding jobs on their own. This is a classic example of the double bind, a mechanism for inducting a scapegoat into his role.[5] We have already mentioned how scapegoating is a part of the process we call "redemption through victimage."

Regardless of the job, very few of our respondents found their own jobs. They can take pride in the fact that they are among an elite group of blind persons who are economically self-sufficient, who are employed. Yet there is a qualification to this pride. The respondent has a job, but he didn't have what it took to get it by himself.

Another factor which bothers some of our respondents is the insecurity of their jobs. The x-ray developers, in particular, showed considerable anxiety over the likelihood that they will be replaced shortly by a machine. Their jobs are insecure because of the manufacturing of x-ray developing machines which many hospitals are now buying.

The jobs which display the greatest concentration of our respondents--x-ray developing and transcribing--are both in danger of becoming obsolete through mechanization and computerization. The jobs which are least likely to become obsolete are the skilled professions which have little representation among our respondents. We have found that there is reluctance by many professional schools to train the blind in skilled work because there is doubt that they can perform this work. There has been only recently, for instance, an awareness that the blind can perform very adequately as automobile mechanics. I interviewed one mechanic who had no difficulty getting a job once he could find someone to train him. If the blind are to avoid the anxiety of being displaced in their job by machines, they must train for skilled jobs.

The employed respondents take considerable, if not complete, pride in the fact that they constitute an economic elite among the blind. They are part of that ten percent of the legally blind in this country who are economically self-sufficient through gainful employment. This pride is slightly tainted by the fact that most of our employed respondents did not obtain their jobs without help and that some of these employed respondents must worry about the duration of their employment inasmuch as they are in jobs which are jeopardized by automation.

SUMMARY AND CONCLUSIONS

We have reviewed the data obtained in interviews with 78 legally blind young adults living in the San Francisco Bay Area. Our respondents were predominantly men. Men outnumbered women 53 to 25. They were relatively young respondents, averaging 28.9 years of age. There were about as many congenitally blind as adventitiously blinded in the sample (37 to 39). There were 43 respondents with no usable vision (either totally blind or having only light perception) and 32 respondents with some usable vision (can make out forms of objects or read large or normal print). There was a slight tendency for the congenitally blind to have more usable vision than did the adventitiously blinded.

Forty-four of our respondents were students. They came from all

three levels of California's tripartite system of higher education--12 from the University of California at Berkeley, 18 from state colleges, and 14 from junior colleges. Thirty-eight respondents were gainfully employed when interviewed. Of these respondents, there were 22 who were regularly employed and 14 who were employed in special sheltered workshops for the blind. The sample allows for a trend analysis of job placement among the blind. We have one group which is preparing for entry into the job market and another which has already experienced the vicissitudes of this market.

A distinction was made between legal and functional blindness. Although all respondents were legally blind, they were by no means all functionally blind. Legal blindness designates a given level of visual acuity which is used as a criterion for ascertaining eligibility for economic assistance. Functional blindness designates how visual acuity affects the behavioral or functional capacities of an individual. Legal blindness was used as a criterion for inclusion in the sample. The amount of functional blindness was more of an independent variable in this study.

We have analyzed the effects which negative public definitions of blindness have on the self-image and normative functioning of the blind. We asked the central research question, "How can the blind, existing as they do in a social structure, which is either nonsupportive or too supportive, maintain a positive self-image and function as competent adults in our society?"

The analysis began with the presentation of a dilemma which was extracted from the interviews. The dilemma points to problems which the blind encounter in maintaining a positive self-image in a sociocultural environment which defines them as helpless and incompetent. The place where these negative definitions were most debilitating for our respondents was in the job market. Being defined as helpless and incompetent, the blind found the doors to economic self-sufficiency and self-fulfillment through work blocked to them. This was a central concern to these respondents because "occupation" is such a significant factor influencing the way in which others perceive us. It also directly affects one's whole style of life.

Work serves many functions for an individual. It is a source of subsistence. It helps us in structuring and organizing our lives. It provides an arena for meeting people. It provides the individual with a source of identity. It is a crucial determinant of one's social status and style of life. It provides meaning and content to one's life.

The person who does not work loses many of these material, social, and psychological benefits which come through work. He is apt to perceive his life as purposeless and devoid of meaning. He is apt to experience symptoms of boredom such as excessive sleepiness or various aches and pains. He is apt to be either extremely passive and withdrawn, wallowing in self-pity, or to take on an aggressive, hostile outlook toward life. He is apt to become increasingly socially isolated from others and experience feelings of loneliness. He is apt to become materially dependent upon others for the necessities of life.

The great majority of legally blind people in the United States are not gainfully employed. There are several reasons for this. The majority of legally blind people in the United States are over 65 years of age. The age at which one is expected to retire is decreasing. The elderly, in general, whether blind or normally sighted, find it extremely hard to achieve economic self-sufficiency through gainful employment. In two respects the ability of the blind to secure welfare benefits operates to reduce their employment. First, our respondents report that employers prefer giving jobs to people whose economic welfare is less assured, and so the blind are hired after other minority groups. Second, some blind people find collecting welfare payments more lucrative and pleasant than working in some dull, monotonous, low-paying job.

Other respondents report difficulty in obtaining jobs because

they are competing directly with other minority groups for jobs. There is more public pressure for the employment of Negroes and Mexican-Americans than there is for the employment of the physically handicapped. Physically handicapped people thus lose jobs to people of other minority groups.

Unions are reluctant to accept legally blind people because the blind cannot always take the normal steps of promotion. Unless they are union members they are blocked from all union shops. The San Francisco Bay Area labor market is highly unionized.

Above all, the blind are unemployed because of a pervasive lack of confidence in their abilities to work safely, quickly, and efficiently. This reflects a public view of the blind as helpless and incompetent. Employers think that their corporate insurance premiums will rise if they hire the blind, because they believe that insurance companies consider the blind a greater accident risk than normally sighted persons. This is particularly true where the blind work with machinery. Employers are reluctant to hire the blind because they fear the smooth-running bureaucratic nature of their businesses will be altered by the special equipment, gauges, labels, or supervision that they feel will be needed when the blind are hired. They are further reluctant to hire the blind because the blind are thought to be slow workers, physically awkward, and responsible for socially awkward situations.

How do these facts translate into a dilemma for the blind? The blind must either accept and internalize the negative definitions which are prevalent in the social structure, in which case they would consider themselves to be helpless and incompetent and just collect their welfare checks, or they could fight these definitions and endure constant rebuff in the job market. The effect of this rebuff is to encourage the adoption of a negative self-image. So the blind are faced with accepting a negative self-image sooner or later.

How are our respondents able to cope with this dilemma and, in the face of it, still maintain a positive self-image? The adaptations are somewhat different for students and for those who have experienced rebuff in the job market.

Students, who are aware that they will encounter difficulties in getting jobs, often "play it safe." This involves preparing for careers in which they believe they stand the best chances of being hired. This is not always the career that they would prefer were there no complications presented by their stigma. The reputedly safe occupations for the blind included teaching, social welfare, and data processing.

Aspiring to careers in these vocational areas is temporarily very functional for many students. How is it functional? Having a vocational goal in these areas facilitates a favorable presentation of self to others. It brings a positive response from others when they hear that a blind person is going to be a teacher, social worker, or computer programmer. One "significant other" who favors these vocational goals is the vocational rehabilitation counselor. He is an important man to please because he dispenses money, services, and materials to students he considers worth sponsoring. The vocational goal of the student goes a long way in determining the student's worthiness in the eyes of his rehab counselor.

Having any vocational goal, particularly one which is highly esteemed by others, provides a source of identity and security. Identity in school is inextricably linked to one's vocational goal. The academic major which a student declares limits the range of occupations for which he qualifies. Partly because of pressure from parents, school administrators, relatives, and friends who want to know what the student anticipates doing with his college education, it is functional and secure to have an acceptable answer to this question.

Among our student respondents there are some rather unrealistic vocational choices. They are unrealistic because in making them students did not take the demands of the job market into account. They failed to consider that they were

going into the same fields that normally sighted students were flooding. They were thus entering areas of maximum competition for jobs. This competition was enhanced by cutbacks in government spending on education and social welfare. This reduced the anticipated expansion of jobs in these fields. Although a great deal of publicity existed in 1962 about how there were already 60 legally blind teachers teaching in the state of California, scant attention has been paid to how little this figure has changed since then.

Blind college students frequently adopt vocational goals which are acceptable to others as a way of maintaining a favorable presentation of self. These goals are not always very realistic. The absence of rationality in the vocational planning of some respondents stemmed from a lack of information about occupations. This is a problem of socialization.

We normally discover details about vocations from speaking with people who are working in them. But in this respect the blind are handicapped because of the difficulties they encounter in initiating conversation and with social relationships in general. It thus seems advisable to have career information available to the blind in high school. This information was noticeably absent among our respondents. When I use the phrase "information about occupations," I do not specifically mean occupations for the blind. Knowledge about all occupations would perhaps expand the range of jobs into which the blind now venture.

The dissemination of this occupational information could be part of a county-wide career day or as part of a special education high school program. A career day would have the advantage of introducing a maximum number of blind students to prospective employers so that they could get a good picture of the total employment picture. It would also acquaint prospective employers with a wide variety of graduating, talented blind people, which might begin a process of removing some of their doubts regarding the capabilities of the blind.

As an individualized program in special education for the blind, resource or itinerant teachers could take students on tours of plants and for talks with personnel directors of firms to familiarize the students and corporate personnel with one another. This would not only result in knowledge about specific jobs, but would be valuable interview experience for students. There is much that can be done to expand the blind students' knowledge about and experience within the job market.

Once a student graduates he peddles his skills in the job market. If he is blind he is apt to find no takers. The experience of consistent denial is a severe blow to one's ego. We analyzed how a blind person maintains a positive self-image in the face of these rebuffs.

One adaptive mechanism was called "redemption through victimage." The blind cannot blame themselves for their inability to find jobs. If they did they would have to say that nobody would hire them because they were incompetent, or at least not as competent as the normally sighted people who were being hired. The blind therefore redeem themselves from blame for their situation by victimizing their vocational rehabilitation counselors. The rehabilitation counselor and his clients hold discrepant views concerning the counselor's role. Clients viewed the rehabilitation counselor's role as one of finding jobs for his clients. The fact that respondents were at any time unemployed was thus their counselor's fault and not theirs.

The counselor sees his role as a counselor and not a job placement director. This is functional in that if he performed the job of a placement director adequately his clients would be unable to use him as a scapegoat. They would be unable to redeem themselves by victimizing their vocational rehabilitation counselor.

When refused employment some respondents return to school either for an advanced degree or to begin training in a new field. Colleges

and universities provide a sheltered environment for the blind. Unlike corporations, colleges will accept as a student anyone who is willing and able to perform the tasks which they require. They perform many of the same functions for the individual that work performs: they provide an arena for meeting people, they structure time, and give purpose and content to life. As a result, when a blind person cannot find work he often returns to school. In the eyes of others this is a much more acceptable adaptation than staying home and feeling sorry for yourself while collecting welfare. It is an adaptation which enables the individual to maintain a positive self-image in the face of unemployment.

Some respondents prefer not to return to school and go into sheltered workshops for the blind instead. In many respects this work is demoralizing. The work is very mechanical and routine. It offers little variety and little challenge or stimulation. It also offers minimal financial compensation. Most workers do not earn enough money to become ineligible for welfare payments. The work involves the making of mops, brooms, pillowcases, washcloths, and redwood planters. Yet despite all its faults it is work nevertheless, and as such it has advantages over no work. It brings the worker extra money, it structures his time, it gives him social contacts, and it is preferable to the boredom of long-term unemployment. The consensus of our respondents is that sheltered shop work is demoralizing, yet it is better than and brings more self-respect than no work at all.

Through work man becomes integrated into the fabric of his society. When he cannot find work he often must find other paths which lead to this integration. Without this integration, man feels isolated, estranged, alienated. One path which the blind frequently take toward this integration is political activism. In this respect the blind become dichotomized into two camps -- integrationists and segregationists. They become very much like other minority groups in this respect. The integrationists want to be treated like normally sighted persons in the society. They want no special treatment for the blind: no special jobs, no special tax deductions, no special educational facilities. They want to eliminate the distinction between blind and normally sighted people. The segregationists lobby for greater welfare benefits for the blind, more tax benefits, and more special dispensations in general. It is through participation in the political process that many blind people find causes to fight for, things to get involved in, people to meet, and a purpose in life. It is at times a rewarding addition to or substitute for work.

Yet another way in which the blind maintain a positive self-image is by being closely attached to groups of other blind people. The peer group acts as a buffer, neutralizing the acidity of negative feedback which the blind experience in their everyday world. Here again this clannishness which is born out of a distinction between "we" and "they" is not unique to the blind, but exists among other minority groups as well.

We have periodically alluded to differences and similarities between the situation of the blind and the situation of other stigmatized minority groups: Blacks, Mexican-Americans, ex-convicts, ex-mental patients, the elderly, and people with other physical handicaps. My abbreviated acquaintance with these other groups indicates that they experience problems which are remarkably similar to those of the blind. There is the denial of self which is especially evident in the job market. There is the frustration caused by this denial and the losses for the individual which come from unemployment. The techniques which the blind employ in adapting to these experiences are also found in many of these other minority groups.

As one reads the writings of Louis Wirth and compares these theoretical conceptualizations with the empirical reality of minority groups like the blind, one realizes a tremendous potential for the further development of generalities regarding minority group experience. Writing in the 1920's, Wirth nicely summarizes the situation of the blind and other minority groups when he writes:

"We may define a minority as a group of people who, because of their physical or cultural characteristics, are singled out from the others in the society in which they live for differential and unequal treatment, and who therefore regard themselves as objects of collective discrimination. The existence of a minority in a society implies the existence of a corresponding dominant group enjoying higher social status and greater privileges. Minority status carries with it the exclusion from full participation in the life of the society. Though not necessarily an alien group, the minority is treated and regards itself as a people apart."

". . . Minorities objectively occupy a disadvantageous position in society. As contrasted with the dominant group they are debarred from certain opportunities -- economic, social, and political. These deprivations circumscribe the individual's freedom of choice and self-development. The members of minority groups are held in lower esteem and may even be objects of contempt, hatred, ridicule, and violence. They are generally socially isolated and frequently spatially segregated. Their subordinate position becomes manifest in their unequal access to educational opportunities and in their restricted scope of occupational and professional advancement. . ."

". . . minorities tend to develop a set of attitudes, forms of behavior, and other subjective characteristics which tend further to set them apart. One cannot long discriminate against people without generating in them a sense of isolation and of persecution and without giving them a conception of themselves as more different from others than in fact they are. Whether, as a result of this differential treatment, the minority comes to suffer from a sense of its own inferiority or develops a feeling that it is unjustly treated -- which may lead to a rebellious attitude -- depends in part upon the length of time that its status has existed and in part upon the total social setting in which the differential treatment operates."

". . . minorities, driven by a sense of frustration and unjustified subordination, are likely to refuse to accept their status and their deprivation without some effort to improve their lot. When the sentiments and attitude of such a disadvantaged group become articulate, and when the members become conscious of their deprivations and conceive of themselves as persons having rights, and when they clamor for emancipation and equality, a minority becomes a political force to be reckoned with. To the individual members of such a group the most onerous circumstance under which they have to labor is that they are treated as members of a category, irrespective of their individual merits."[6]

Through analysis of the legally blind young adult we have laid a foundation for some comparative analyses of different kinds of minority groups. It is hoped that by working inductively, the empirical material presented here, when compared with empirical material on other minority groups, will lead to some theoretical generalizations about stigmatized minorities.

We have presented here one potentially fruitful analytic question which might be explored further in these comparisons: In the face of negative public sanctions, how do stimatized groups maintain positive self-images? This question lies at the heart of the minority group experience.

How do our findings reinforce or complement the findings of other research on blindness? We first turn our attention to Robert A. Scott's recently published book, *The Making of Blind Men.*[7]

Scott starts with Milton D. Graham's distinction between legal and functional blindness.[8] He recognizes that the two are not synonymous and that functional blindness is developed in a process of socialization. Scott examines how public agencies which serve the blind contribute in the making of functionally blind men.

According to Scott, public agencies have adopted definitions of blindness which mirror those found in the general public. In making functionally blind men, rehabilitation agencies emphasize that their clients must avoid minimizing the extent of their handicap. Clients must fully realize that blindness requires extensive adaptation and adjustment. Public agency personnel define the blind as being dependent upon external aid, which is the rationale justifying their existence. Many blind clients formulate role definitions in accordance with these definitions which are offered them. In doing this they become functionally blind.

Scott recognizes that all clients of these public agencies do not become functionally blind. Yet he chooses to focus his analysis on the clients who do become functionally blind. He is thus predisposed to emphasize the abnormalities and handicaps which can be associated with blindness. This emphasis already permeates literature about blindness.

The writings of Thomas J. Carroll also emphasize abnormalities which are associated with blindness.[9] Father Carroll depicts a wide variety of losses which come about as a result of blindness. But these losses are often temporary. They last only until one has found adaptive mechanisms to compensate for them. Father Carroll only minimally recognizes such adaptation. As a result, he contributes to the view that blindness will more often than not result in social and psychological abnormality.

Thomas Cutsforth, in emphasizing the psychological consequences of blindness, portrays the blind as neurotic, selfish, cowardly, homosexual, and incapable of loving.[10] I found not one of our respondents who approximated the picture which Cutsforth presents. Here again, logically, the blind would come to be what Cutsforth describes *if* they had no adaptive mechanisms for coping with the degradation they encounter in their environment. The reason our respondents did not mirror Cutsforth's description was that they had adaptive coping mechanisms.

Scott, Carroll, and Cutsforth all recognize the variable social and psychological consequences of blindness. They all recognize that different people make different kinds of adaptations to blindness. Yet these authors have made certain analytic commitments which lead them to focus on the abnormalities of blindness. One such commitment is to emphasize how elements in the social structure effect a dysfunctional reaction to blindness.

Though man is undoubtedly affected by his sociocultural environment, he is not a passive agent. He meets social structures with specific goals and with an ability to evaluate, criticize, and change events in his environment. Man *interacts* with his environment. From this interaction man may change, but we must not ignore man's ability to resist the forces which try to change him.

We have focused on environmental forces which impinge on the blind man, but we have also focused on how the blind react to and resist these forces. With our attention on these adaptations we come out with an impression of the blind which complements the sometimes grim view of the blind as downtrodden, depressed, helpless, and inept. We find them much less abnormal than they are usually depicted to be.

I do not wish to imply that the blind are unaffected by their treatment in the social order. They are. They have special problems and concerns which are not normative. They must perform some acts in unconventional ways. But at the same time they do have at their disposal defenses which protect them psychologically. Because they have these mechanisms many of our respondents are able to maintain some measure of normalcy. Through this, they are able to bolster a positive self-image.

The more favorable image we get of the blind is in part attributable to the youth of our respondents and to the specific geographical boundaries of our study. But it is also a product of our perspective. It is in capturing the two-way interaction of the blind man with his

sociocultural environment that enables us to understand the differential nature and consequences of blindness.

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NOTES AND REFERENCES

1. "Retinitis pigmentosa is a genetically determined, abiotrophic, degenerative disease which has its onset between six and twelve years of age. It is more common among men than women (3:2), is almost always bilateral, and is most often inherited as an autosomal recessive characteristic. . . . Pathologic findings include bilateral degeneration of the retina (especially the rods), migration of pigment into the retina, obliterative sclerosis of the vessels, and atrophy of the optic nerve." Daniel Vaughan, Robert Cook, and Taylor Asbury. *General Ophthalmology*. Los Altos, California: Lange Medical Publications, 1965, p. 132.

2. This concept came from the lectures of Ernest Becker, given at the University of California, Berkeley, 1965-66. The concept is abstracted from the writings of Marcel Mauss.

3. George E. Simpson and J. Milton Yinger, *Racial and Cultural Minorities*, New York: Harper and Row, 1965, p. 159.

4. This seems to contradict an earlier statement that counselors do not find jobs for their clients. It is not a contradiction in several respects. Counselors are in a very recent transition from being placement directors to counselors. When most of our respondents first got their jobs several years ago, their counselors did more job hunting than they do now. Further, not only do the counselors look for jobs, but also many jobs are dropped into their laps. They do not have to seek out many openings since the employer comes to them. A placement which is sponsored by a rehab counselor does not necessarily mean that the counselor did a lot of leg work to get it. One other point is worth mentioning. The inefficiency of the Department of Vocational Rehabilitation tends to be accentuated by the clients we are interviewing. Redemption through victimage is one reason for this. Despite their supposed or admitted lack of job hunting they need to find *some* of their respondents jobs. They are also probably doing less of this now than they used to do.

5. Ezra Vogel and Norman Bell, "The Emotionally Disturbed Child as the Family Scapegoat," in Bell and Vogel, eds., *A Modern Introduction to the Family*, New York: Free Press, 1968, p. 412. Gregory Bateson, *et al.*, "Toward

a Theory of Schizophrenia," *Behavioral Science*, 1956, p. 251.

6. Louis Wirth, "The Problem of Minority Groups," in Ralph Linton (ed.), *The Science of Man in the World Crisis*. New York: Columbia University Press, 1945, pp. 347-52.

7. Robert A. Scott, *The Making of Blind Men*. New York: Russell Sage Foundation, 1969.

8. Milton D. Graham, "Toward a Functional Definition of Blindness," *Research Bulletin No. 3*, New York: The American Foundation for the Blind, 1963, p. 130.

9. Thomas J. Carroll, *Blindness: What It Is, What It Does, and How to Live With It*. Boston: Little, Brown and Company, 1961.

10. Thomas Cutsforth, "Personality and Social Adjustment Among the Blind," in Paul Zahl, *Blindness*. New York: Hafner, 1962, p. 187.

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EDITOR'S NOTE

Readers should make the following correction in the listing contained in *Research Bulletin* No. 17, July, 1968:

"Preliminary Report on Research Completed in 1966 Using the Kay Ultra Aid for the Blind

H. F. Priest and G. R. Long"

We had no intention of obscuring Miss Long's important contribution to this paper. We are glad to have this opportunity to rectify our error.

THE ADAPTATION OF A NONVERBAL ABSTRACT REASONING TEST FOR USE WITH THE BLIND: REVIEW OF RELATED RESEARCH AND BIBLIOGRAPHY *

John Morse**

REVIEW OF RELATED RESEARCH

The proposed study is designed to adapt a group administered, visually perceived, abstract reasoning subtest for use with the blind. It will be necessary, therefore, to examine the research involving blind and sighted subjects. The research involving sighted subjects only as it is relevant to the successful or proposed adaptation for use with blind subjects will be included.

Literature that pertains to "abstract reasoning" will be discussed whether it be a subtest of an aptitude or an intelligence test since the factor of "abstract reasoning" is common to both types of tests. Anastasi, (1954) states:

> A second factor which has encouraged the development of differential aptitude batteries is the gradual realization that the so-called general intelligence tests are in fact less general than was originally supposed. . . . As these limitations of intelligence tests became evident, psychologists began to qualify the term "intelligence." Distinctions between "academic" and "practical" intelligence were suggested by some. Others spoke of "abstract," "mechanical," and "social" intelligence. . . . But closer analysis showed that the intelligence tests themselves could be said to measure a certain combination of special aptitudes. . . .

No attempt is being made, however, to equate "aptitude" with "intelligence."

Adaptations of the Binet Scales

The intelligence test developed by Binet and published in 1911 was used with blind children in 1914 by Irwin and Goddard by omitting those items which cannot be presented to the blind (Irwin, 1914). In 1923, Hayes (1950) prepared and distributed his *Scissors and Paste Guide*, an instruction booklet which indicated the alterations necessary for the administration of Terman's revision of the Binet scale to blind subjects. It was necessary to place a number of the items below the age levels for normal children since the blind children were found to be slower in certain phases of mental development than sighted children. The intent of Hayes' (1950) standardization was to develop a more normal distribution of intelligence quotients in the blind sample than was obtained by use of the Terman and Goddard adaptations of the Binet.

In 1930 Hayes (1950) made further revisions of the test which improved its test-retest reliability and gave substantial correlations with other intelligence tests.

Publication of the Terman-Merrill revision of the Binet

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*The material published here has been excerpted from a dissertation submitted by Dr. Morse at Boston University in partial fulfillment of the requirements for the Ph.D. degree in 1970.

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occasioned further refinement of Hayes' test. All materials requiring vision were eliminated and the L and M series of the Terman-Merrill were combined to supplement the items from the 1930 edition of the Hayes test. Six tests were located at each age level from age three up to adult levels. This version was published as the *Interim Hayes-Binet* (Hayes, 1950). The author reported a test-retest reliability coefficient of 0.90 and the correlation of 0.83 with the Wechsler-Bellevue Verbal Scale.

Both of the aforementioned tests utilize the normative data for seeing subjects rather than having established normative data for blind subjects. Comparison of the performance of blind subjects on the Hayes-Binet Tests of Intelligence, 1930, with the performance of the normative group of the Stanford-Binet Intelligence scale, 1916, indicated that the blind scored consistently lower on this test than did seeing subjects. Although the Interim Hayes-Binet Tests of Intelligence for the Blind, 1942, have been in constant use since that date, no comparative studies between the performance of blind and seeing subjects have been made other than a comparison of frequency distributions of the performance of blind subjects with the distribution of the normative group as described by Terman. These latter comparisons indicate that differences between groups do exist. Nonetheless, the latter test is probably the most widely used measure of the intelligence of blind subjects; this is so in spite of the recognized deficiencies of its dependence upon normative data derived from non-blind subjects and the absence of nonverbal materials (Davis, 1962).

In the work with the test mentioned in the preceding paragraph no attempt was made to analyze possible differences in performance of blind subjects in relationship to etiology and time of onset of blindness. Early studies by Hayes utilizing earlier tests (the Irwin-Binet Tests of Intelligence for the Blind) showed that there is no variation in general intelligence with respect to the age at which sight is lost. However, since that time a new class of blind individual has developed (whose blindness is due to retrolental fibroplasia) who are essentially totally blind from birth and in whom in part, at least, there is a possibility of concomitant brain injury.

The Wechsler Tests

The tests developed by Wechsler (1944, 1949, 1955) are used for the blind by omitting the performance half of the test and by slightly modifying the administration of the verbal scale. Correlations with the Hayes test have been found to range from 0.81 to 0.95 (Hayes, 1950).

Group Intelligence Tests

Several standard group intelligence tests have been printed in braille for administration to blind children. These include the Kuhlman-Anderson Intelligence Tests, Grades 6 to 12; the Otis Classification Test: Form A; the Scholastic Aptitude Test for the Blind; and the Pintner General Ability Tests -- Verbal Scales (Bauman, 1951; Rawls, 1954). When used with blind children the correlations of these tests with the Hayes test range from 0.57 to 0.76 (Hayes, 1950).

In the 1920's and the 1930's Hayes and others made a brief attempt to adapt group tests of intelligence for use with the blind. However, they felt that their efforts were not sufficiently successful to warrant continuance of such work. Later efforts were based upon individual tests of learning ability. However, the widespread success of the Scholastic Aptitude Test of the College Entrance Examination Board has demonstrated that group tests can be used with satisfying results. M. A. Pearson (Davis, 1962) undertook in a doctoral dissertation to establish normative data for fourth, fifth, and sixth grade blind and partially seeing children using the School and College Ability Test (SCAT), Level 5. The SCAT Form A was transcribed and multigraphed in braille and printed in large type. This form was administered to 117 braille readers and 82 large-type readers

in seven residential schools for the blind. From the results obtained it may be concluded that this test can become useful as a measure of scholastic ability for blind students. Mean performances on the tests were significantly greater for each subsequent grade.

It should be noted that none of the tests mentioned above included a nonverbal measure of abstract reasoning.

Nonverbal Tests for the Blind, Individually Administered

The first efforts to test the manual and mechanical ability of the blind were made by Hayes in the 1930's (Bauman, 1950). Various tests were studied for potential use with the blind, e.g., tapping, card sorting, block design, finger dexterity, etc. Bauman (1946) used manual dexterity tests for the selection of blind workers for the defense industry. Further extension of this work can be seen in the test batteries developed by the U.S. Civil Service Commission (Rich, 1963), for the evaluation and placement of blind workers.

T. Ernest Newland (1969) developed a blind learning aptitude test (BLAT) for use with blind children utilizing a cutaneous-kinesthetic presentation of items. It was Newland's conviction that the cutaneous-kinesthetic input channel should be involved since it figures importantly in learning by the blind. Moreover, the motive behind the construction of the test was the author's concern that blind children had not had as nutrient an acculturation as did the majority of children.

The responses of 961 functionally blind children in 12 states constituted the normative data for the BLAT. An internal consistency correlation of 0.934 and a test-retest reliability correlation of 0.865 were obtained. BLAT scores correlated 0.74 with the Hayes-Binet mental ages, and 0.71 with WISC Verbal I.Q. scores.

Newland felt that the BLAT and the Raven differed from other conventional tests of intelligence with respect to the kinds of behavior sampled. These two tests ". . . sampled the fundamental psychological processes which made possible the 'achievement' sampled in the majority of tests. BLAT was then perceived as sampling at the process end of a 'process-product' continuum along which various 'intelligence' tests could be placed. . ." (Newland, 1969).

Bauman (1950) described her Non-language Learning Test as a form board in which there are eight holes, each of which can be filled with two or three blocks. The board is presented to the subject with four of the blocks removed. The blocks remaining are so arranged that it is necessary to make a series of moves with the blocks still in the board before those which have been taken out can be replaced. The blind subject is taught the most efficient series of moves by which to replace the four blocks and is tested for retention. According to its author, the test may be considered an assessment of mechanical ability. Correlations with intelligence tests were reported to be positive, but small. Since the partially sighted are superior to the totally blind on the test, different norms are provided in each group.

Finger and stylus mazes have been used as tests for the blind. Carr (1921) used four blind subjects as a control group for the study of maze learning and found that they were at a disadvantage when compared to blindfolded sighted subjects. Koch and Ufkess (1956) found that the blind were less successful than normals in mastering mazes. They found that subjects who had some visual experience prior to onset of blindness were superior to those subjects who had not had such experiences. MacFarland (1952) concluded that motivational differences as well as mental imagery and kinesthetic memory play important roles in determining the blind subject's capacity to learn the maze. Tenacity and perseverance may be vital to good performance on mazes.

Several investigators have reported that if tactually perceptible surfaces are substituted for the colors on the Kohs blocks, a test of

intelligence can be developed that can be used with the blind, much as the Standard Block Design test is used with sighted subjects (Ohwaki, 1958; Oi, 1957; Watson, 1956). Wattron (1956) reported a correlation between the scores of blind children on the Block Design Test with the Hayes-Binet mental ages to be 0.84.

Tiffin (1960) has developed a performance test of intelligence for the adult blind. The Vocational Intelligence Scale for the Adult Blind is composed of 43 items. Each item is a series of four geometric patterns readily discernible through both touch and sight. Three of the patterns are similar in some way and the fourth is different from the others. The subject must decide which pattern is most unlike the other three patterns.

Since the subjects were asked to examine each pattern tactually, an attempt was made to control or at least reduce as much as possible the effect of individual differences with regard to fine tactual discrimination. The items were constructed as large as possible within practical limitations. There were three item size classifications depending on the complexity of the iternal design, namely, 1-1/4 inches, 1-5/8 inches, and 2 inches. The width of the raised lines varied from 1/16 to 1/8 inch. Correlations between his test and various criteria of job success range from 0.40 to 0.69 indicating that the test may possess considerable predictive validity. The Kuder-Richardson reliability coefficient was found to be 0.91.

Shurrager (1961) has developed a performance test which has been designated the Haptic Intelligence Scale. The test is composed of the following subscales: Digit Symbol, Object Assembly, Block Design, Object Completion, Pattern Board, and Bead Arithmetic. A normative sample of 700 blind adults was tested. Test-retest reliability coefficients for the subscales range from 0.70 to 0.81. The corrected split-half reliability coefficient of the test was 0.95 for 399 subjects, 20 to 34 years of age. Test-retest reliability after an interval of six months for five subscales combined was 0.91 for 124 subjects. Correlations with the Wechsler Adult Intelligence Scales (verbal) was 0.65.

The Haptic Intelligence Scale was developed from the work of Watson (1956). He investigated the performance abilities of adults, both blind and sighted, when vision was held constant and the primary role of perception was assumed by the sensory organs of touch and movement. He attempted to control vision by the use of a mask. He assumed, therefore, that all subjects were restricted to perceptual functions of the tactual and kinesthetic sense organs. Moreover, the position was taken that familiarity with the objects by nonsighted subjects would equalize the influence of visual memory on the results of the test by sighted subjects. These assumptions are not valid and will be discussed in the following section, Problems of Test Development for the Blind.

Penrose and Raven (Rich, 1963) in 1936 devised a test of nonverbal mental ability which could be used with a large variety of subjects. Raven in 1960 made preliminary studies of an adaptation of the test, the Progressive Matrices, to a tactual format for use with the blind. He reported that the blind were too variable in tactual sensitivity for reliable assessment of mental ability with these materials.

Anderson (1964) attempted to avoid the problem of variable tactual sensitivity in the blind by constructing his version of the Progressive Matrices of heavy materials and by simplifying the stimulus patterns to essential relations. Results indicate that his tactual test shows promise as a mental test for blind children and correlates in a statistically significant positive manner with standard tests of intelligence when used with blind children. His tactual test correlated 0.31 with the WISC verbal scale. The adult version correlated 0.49 with the WAIS verbal scale.

Rich (1963) attempted to administer individually the Progressive Matrices as modified by Anderson (1964) to a small sample of blind children at the Houston Council for Blind Children. The questions he

posed were, "Can the tactual problems be solved by blind children?" and "Do scores on the tactual test correlate with scores from standard intelligence tests?" The experimental test consisted of copies of the items included in Raven's Coloured Progressive Matrices (CPM). Each item consisted of a ground with a raised design so the design could be tactually perceived. Each design was 2 inches by 1-1/4 inches in area. The height of the raised designs was from 1/16 inch to 1/4 inch, depending on the item. The split-half reliability coefficient was 0.95. His test correlated 0.31 with the WISC verbal scale.

Davis (1962) has been conducting a project entitled The Standardization of the Perkins-Binet Tests for the Blind. The purpose of the project is to undertake a standardization procedure for an intelligence test for "legally blind" children and young adults which will be designated the Perkins-Binet Tests of Intelligence for the Blind. The test will be an adaptation of the Stanford-Binet Intelligence Scale Form L-M (1960) and it will utilize some material from the Interim Hayes-Binet Tests of Intelligence for the Blind (1942). Normative data for blind subjects will be established following procedures similar to those utilized in standardization of the Stanford-Binet Intelligence Scale Forms L and M (1937). The scale of intelligence will approximate the Stanford-Binet Intelligence Scales Form L-M (1960) in structure and content, but the normative data will be based upon blind subjects.

Problems of Test Development for the Blind

Development of tests for the blind is made difficult by the geographical dispersion of the blind population and by the wide differences that exist between individuals who are "legally blind." The degree of vision loss varies from total blindness through light perception and motion perception to partial vision. Within each of these groups there are those persons who have never had useful vision and those with good memories of visual experience (Bauman, 1951).

Differences among blind subjects must be considered in the standardization of tests for the blind. Tiffin (1960) reported that speed of performance is related to the age of onset of blindness in adults. Worchell (1951) found a relationship between the age of blinding and tests for space perception.

Bauman (1950) reported that those "legally blind" subjects who have retained some vision have an advantage over the totally blind subjects in the performance of manual tasks chiefly because of their greater facility in orienting themselves in the work space. Thus, standardization of tests for the blind must be carried out with full consideration of the wide differences in performance which may exist in the population on the basis of the degree and history of the subject handicapped.

Watson's (1956) assumptions that vision was held constant by the use of a mask and that the primary role of perception was assumed by the sensory organs of touch are invalid and unrealistic. The congenitally blind subject who has never had sight perceives through the use of the sensory modality of touch. However, those blind subjects who had or have varying degrees of vision form visual memories which affect the perceptual process. These memories may aid or hinder the perceptual process depending on the degree and accuracy of what is seen and what is remembered.

Moreover, it was recognized by Tiffin (1960), Jones (1960), and Gruber (1959) that vision should not be held constant in an investigation of the aptitudes of the blind. They recognized that the development of an instrument to aid in the educational and vocational placement of blind people must reflect certain realities. Jones (1960) states:

> The use of a blindfold was considered to result in an unrealistic appraisal of an individual's capability. Since a worker does not perform his duties when wearing a mask, any attempt to assess his potential

when blindfolded seems unwarranted.

Others involved in the testing of the blind, according to Jones (1960), have also expressed this position.

Furthermore, Jones (1960) suggests that those investigators who try to control vision and visual memories by use of a mask or by familiarity with the objects to be studied, substitute for the visual advantage of the partially sighted or seeing person the greater tactual experience of the totally blind.

Last, the degree and accuracy of visual memory varies among blind subjects who had or have some sight, and never approximates the visual memory of sighted subjects. The degree and accuracy of visual memories possessed by blind subjects depends on the time of the onset of blindness, when the subject had sight and for how long, the degree of remaining vision, and the type and quality of experiences the blind subject has been exposed to before (if applicable), during, and after the loss of sight.

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THE ELECTRO-BRAILLER: A COMMUNICATIONS DEVICE AND TEACHING AID FOR THE BLIND AND VISUALLY IMPAIRED AT WORK AND IN SCHOOL

Hans Schopper*

The invention of Louis Braille's writing system of raised dots had the same far-reaching consequences for the blind as the invention of printing with movable type has had for the sighted. It opened for the blind an entry into the recorded world of the sighted, and helped pave their way toward a more dignified and fuller life.

Many blind persons today are able to participate fully in the domains of work and of leisure alongside their sighted fellows. This is due, in part, to advances in technology which have allowed us to turn the legacy of Braille's invention to good account in the demands of the present and the future for written text.

But the development of up-to-date and effective aids remains a constant challenge and a permanent charge to technologists. One result of recent effort is the "Electro-Brailler." It is designed to be a teaching aid, a piece of office equipment, and a means of communication which can aid the blind and the deaf-blind in school, in the professions, in work, and in private life.

CONSTRUCTION AND OPERATION

The device is a braille transcribing aid which operates with the help of electricity. There are essentially two parts: the braille transcriber, which acts as the transmitter; and the braillewriter, which acts as the receiver.

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The braille transcriber is an adapter mounted on a braillewriter, a braille keyboard, or an ordinary typewriter. Pressing the keys down generates electric impulses which are converted into braille dots by the braillewriter. The brailled material appears in the form of an embossed tape (the device is thus a braille tapewriter). There are plans under way for the construction of a version that will write on sheets of paper as well.

USE OF THE DEVICE

The Electro-Brailler can be used in many different ways, among which the following are suggested:

In schools for the blind and the deaf-blind as a substitute for the blackboard used for the sighted;

As an electric shorthand typewriter;

As conference equipment for the deaf-blind;

As a teletyper for the deaf-blind, taking the place of the telephone earpiece for hearing;

As a conversion device from ink-print into braille, as an aid for the blind typist, and as a means of creating written information for the blind.

Let us discuss each of these applications briefly. First, as a substitute for the blackboard in schools for the blind and the deaf-blind one can use one braille transcribing unit built into the teacher's desk, and a suitable number of braille writers built into the students' desks. This system allows the

teacher to write to all of the students in a class simultaneously and directly. The teacher can therefore transmit information in braille, to introduce new foreign language words, to illustrate peculiarities of spelling in the mother tongue, to illustrate mathematical ideas, or to convey music.

With the use of an ordinary typewriter as a transcriber even those teachers in special education who do not know braille are able to communicate in braille with their students.

There are four variants of the equipment as a substitute blackboard:

1. Basic form in which the teacher may communicate with one or more of the students in the class in writing by using a master unit (a braille typewriter, a braille keyboard, or a normal typewriter) at the teacher's desk.

2. "S" form, which allows students to take notes in braille on their own braille keys.

3. "T" form, which allows direct communication of student with teacher at the discretion of the teacher.

4. "C" form or conference connection by which text generated by a student selected by the teacher is simultaneously sent to each student station in the class and to the teacher.

It is believed that the Electro-Brailler has great advantages over current practices in teaching reading and writing in braille to beginners at the primary school level. Chief among these is the fact that so little mechanical effort is required to use the system, as compared with the use of the mechanical brailler. The electric brailler system avoids the danger of straining the weak and unpracticed fingers of children, and the danger of bad posture developing as a consequence. Writing braille with slate and stylus requires the additional mental effort of mirror reversal, with the danger of learning incorrectly formed characters. Students must write from right to left without immediate feedback of their embossing, and then read from left to right after taking the writing sheet out of the frame. This seems a clumsy and unnecessary impediment to ease in writing braille. The Electro-Brailler, in contrast, provides positive braille which is accessible immediately. Moreover the use of the keyboard does not require much effort; a slight and adjustable pressure is all that is necessary. The minimum pressure is about 120 grams; the maximum is about 800 grams, approximately the pressure required to depress the keys of a mechanical embosser. Thus the Electro-Brailler can be used even with the youngest classes in school. The force required to activate the keys can be increased over the grades gradually, so that one ends up with the pressure required to operate standard mechanical braillers, without the danger of overstressing young muscles or developing bad postural habits. Younger users also need not be concerned about paper insertion, line spacing, or carriage return.

It is also possible to adapt the keyboard to special requirements for the one-handed or the Thalidomide victim.

Second, if one combines the braillewriter with a braille keyboard (that is, dots one to six, or one to eight, plus a spare key) the braillewriter becomes an electric shorthand machine. As the dots are embossed indirectly, a blind stenographer need not exert as much effort as with direct embossing. This may help make for higher speeds in writing while reducing fatigue of the stenotypist.

Third, by interconnecting several stenobraillers it is possible for any number of deaf-blind persons to take part in a "written discussion" at the same time. Moreover, if an ordinary typewriter is connected to a braille transcribing unit, those who do not know either braille or lorming (the hand sign alphabet) can participate with deaf-blind conference participants. It would seem that writing and reading of braille is more economical of

time and effort than sign language, and the use of the written form may help avoid misunderstanding. Finally, the "written discussion" itself serves as a record of the meeting.

In the school for the deaf-blind the Electro-Brailler conference equipment permits teacher and students to talk to one another directly. Whatever a particular person may write on his steno-brailler appears immediately in braille on everyone else's machine. Order in the discussion can be maintained by means of buzzers attached to the wrists of participants, which will indicate when an individual may initiate communication with others.

Fourth, by interconnecting stenobraillers, a braille teletyper system is generated which can be designed as a substitute for a telephone not otherwise practicable for the deaf-blind. In institutes for the deaf-blind a call signal can be transmitted through personal call frequencies which differ for each individual (the Siemens "Mobilruf" is one example), with a vibrator as the tactile output. The person called goes to a conveniently located stenotyper and can conduct a two-way conversation with another person remote from him.

With serial transmission the braille teleprinter could be used as the Telex/Teleprinter, to transmit braille trunk calls over long distances.

Finally, the system can be used by the sighted for conversion of ink print into braille. A combination of an ordinary typewriter and a braillewriter makes direct conversion possible. Other uses of the system include:

1. A readout for a blind typist to detect errors and locate the last typed character, permitting greater independence for the typist.

2. Checking the text output of automatic machines using punched-card or tape-recorded material. This opens the possibility of extending the blind typist's field of activity to include the operation and programming of modern office machines.

3. To produce braille versions of inkprint texts by persons who do not know braille codes, i.e., physicians' instructions to a blind masseur, data for blind typists, clerks, and programmers, and correspondence between sighted and blind persons.

4. For communication between sighted people knowing no codes and the deaf-blind who know braille.

The serial production of this system, developed by the author, is being undertaken by the firm Gureg Elektronik GmbH, D 8013, München-Haar, Zunftstrasse 11, West Germany. The Electro-Brailler is registered with the Deutsches Patentamt as No. P 37 313 VII b/15 g, (September 13, 1965).

I shall be glad to provide any additional information about the system that readers may require.

Ed. Note: Two class rooms at a deaf-blind institute have been equipped with 12 and 15 Electro-Braillers respectively since April of 1969; and 10 Electro-Braillers have been installed in the Bavarian Rehabilitation Center in Saulgrub during May of 1969. An account of the experience so far was published in the May 1970 issue of *Blindenwelt*, in German, and a photocopy of the description is available to any reader upon request to us.

IMPROVEMENT OF BRAILLE READING THROUGH CODE RECOGNITION TRAINING: REVIEW OF THE LITERATURE AND BIBLIOGRAPHY*

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English Braille--American Edition, 1959 (AAWB-AEVH, 1969) became the authorized braille code for use in the United States less than 12 years ago. The need for even minor revisions in 1962, 1966, and 1968 helps to emphasize the attempts to alleviate problems encountered by braillists and braille readers and also the efforts to keep the literary code concurrent with new innovations and formats being used in print. However, three revisions in eight years also magnifies the fact that the braille system has still not reached complete maturation.

Although the development of braille has been one of the most meaningful benefits ever afforded the blind, embossed media for reading and writing have a surprisingly controversial history. The "Battle of the Types" (Farrell, 1956) and the "War of the Dots" (Irwin, 1955) were representative references to the early bitter attempts to find an acceptable uniform type for the blind. Louis Braille published the first description of his raised dot system in 1829 (French, 1932), and it was adopted by the Missouri School for the Blind in 1860. The adoption by an American school did not signify acceptance of the braille system in this country, but rather the start of almost 70 years of debate and research before eventual agreement.

Revised Braille Grade 1-1/2, which contains 44 one-cell contractions, was the official code in the United States from 1918 to 1932. Standard English, Grade 1 and 2, was officially accepted as the system of braille to be used by all English-speaking countries in 1932. Grade 1 consists of 26 alphabet symbols and all words are fully spelled. Grade 2, which is used almost exclusively today, presently contains 189 contractions and short-form words in addition to the alphabetic symbols. Knowing that the braille code had to survive numerous disagreements makes it easier for one to understand why the reading process and instructional procedures for braille are still in great need of objective research. Only four books have been written which pertain to the subject of braille and braille reading: Burklen (1932); Maxfield (1928); Lowenfeld, Abel and Hatlen (1969); and Nolan and Kederis (1969). Reviews of the research which have been conducted are found in Ashcroft (1960, p. 8-23), Hanley (1961), Rogers (1961), Henderson (1967, p. 8-30), Nolan and Ashcroft (1969) and Rex (1970, p. 93-109). Ashcroft (1960) has made the most cogent suggestions for additional code revisions.

LEGIBILITY

This review will not reiterate the controversy surrounding the decisions and reasons for using Braille Grade 2 as opposed to Grade 1 or 1-1/2. It should be acknowledged, though, that in one study the literary contracted braille used today represented a 31 percent reduction in the number of cells that would be necessary in alphabetic

*The material reproduced here has been extracted from the author's dissertation submitted in partial fulfillment of the requirements for the Ed. D. degree in 1970.

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braille (Kederis, Siems, & Haynes, 1965). For example, the word "and" in contracted braille saved 26,120 letters, and the word "the" saved 49,620 letters. The Kederis et al. study was a frequency count of Braille Grade 2 symbology as matched against approximately 291,000 print words contained in 12 books with reading levels from fourth grade to adult.

Burklen (1932) in Germany reported on some of the earliest investigations concerned with both the size and spacing of dots. His results were based on experiments which sometimes used wooden tablets with large braille dots made of nail heads (p. 20). The Uniform Type Committee (1913) conducted the first investigations in America concerned with size and spacing of braille characters. Further experiments were reported by Maxfield (1928) with the suggestion that possibly the height of dots for young children should vary from those used for adult braille readers. Meyers and Ethington (1956) and Calvin and Clark (1958), in unpublished manuscripts, and Meyers, Ethington and Ashcroft (1958) reported the results of several studies which compared the readability of braille in which the spacings between dots within cells, between cells, and between lines were varied over three distances for each. The 0.090-inch spacing within the cell was considered the most effective for both adults and children as was a 0.220-inch spacing between lines of braille. For spacing between cells 0.123 inch or 0.140 was superior for children whereas 0.160 inch was more readable for adults. The height of the dots was 0.015 inch while their diameter was 0.005 inch. Spacing used today (Ashcroft & Henderson, 1964, p. 9) is 0.090 inch between the centers of dots both vertically and horizontally within a cell. Between cells, the spacing is 0.160 inch with the height of the dots usually being 0.025 inch or less.

Spacing is also of great importance concerning the number and position of dots within cells, contractions, and words. Burklen (1932) concluded from a series of experiments that, contrary to popular opinion, the number of dots within a character had negligible effects upon readability. Burklen considered this to be the most important and obvious result to be drawn from his experiments. His results were undoubtedly greatly affected by using braille characters embossed on tin instead of on paper (p. 20) and by placing rubber caps on the fingers (p. 21) in some of the experiments. The position or pattern of the dots did make a difference according to the findings of the Uniform Type Committee (1908, 1910).

Studies I-IV by Nolan and Kederis (1969) showed that while the number of dots within a word did appear to be a significant variable in favor of fewer dots, no systematic pattern for this effect could be established except that characters and words with most of the dots on the left and in the upper part of the cell were more easily recognized than those with many dots, dots on the right, and on the bottom half of the cell. The Nolan et al. experiments also indicated that with respect to speed and errors made, intellectual differences rather than tactual ability may have been the most significant factor for fast and slow readers. Characters with dots more widely dispersed were more easily recognized, and 86 percent of the errors were due to missed dots. The number of dots, the position of dots, and the presence or absence of contractions and their orthography within words were all significantly related. Even though no clear-cut patterns of relationship were pin-pointed, these various factors did interact in their effects on recognition and readability.

FREQUENCY OF APPEARANCE OF CHARACTERS AND CONTRACTIONS

The frequency with which individual elements of the braille code occur in literature is important to braille readers because of the amount of space which is saved, and because greater frequency of various components of the code facilitates braille reading and writing. Irwin and Wilcox (1929) did a frequency count on both Grade 1-1/2 and Grade 2 braille in order to obtain information regarding the space saving value of the contractions peculiar to Braille Grade 2 when compared to Grade 1-1/2. Using

91,564 words from four adult books, they found that Grade 2 required almost 12 percent less space.

Staack (1962), using a count of approximately 7,000 words, demonstrated that a computer can be programmed to make frequency counts. Modifying the computer program used at the American Printing House for the Blind which translates ink print into braille, Kederis et al. (1965) obtained frequencies on approximately 291,000 words as mentioned earlier. In addition to finding the number of letters saved by using contracted braille, the number of occurrences of the alphabet letters in English print, and the number of occurrences of the 63 single-cell braille characters, Kederis et al. found the number of occurrences of dots by position within the braille cell. Table 1 reveals that dots on the left of the cell occurred 7 percent more often than the dots on the right. The upper dots were 8 percent more prevalent than the lower ones. The occurrence of dots in their various positions was in a direct inverse relationship with the frequency of missed dots by cell position.

Hooper (1946) tabulated the occurrence of braille contractions and the grade levels at which they first appeared in primary school children's reading vocabularies. From 13,038 words in 21 reading series used in the first six grades, she found that 144 of the braille signs appeared in the first grade vocabulary. Seventeen additional signs were introduced in the second grade, five in the third, six in the fourth, three in the fifth, and five in the sixth grade. Only five signs were not used before the sixth grade: braille, conceive, conceiving, oneself, and thyself. The Thorndike Word List was also used to determine the frequency of occurrence of the contractions, and it was found that of the 185 contractions then officially in use, 152 of them were found in the first 1000 category of the Thorndike List.

Rex (1970) analyzed four basal reader series, preprimer level through second semester, third grade level, in terms of the use of contractions in the braille transliteration of materials used in teaching reading to blind children. It was found that 165 or 87 percent of the braille contractions had been introduced by the end of the third grade in the four series. Only 136 contractions were introduced in one of the series, whereas another had 145, and two of the basal reader series introduced 152 contractions. All four of the series introduced 131 of the same contractions, and 14 contractions had use in only one of the series.

BRAILLE READING INSTRUCTION

All too frequently a program of reading instruction is followed from year to year with little or no evidence of its real value. Rarely is there careful evaluation of the techniques and processes used. Evidence of the inadequacy of many of these programs is illustrated by children who do not learn to read

Table 1

Number of Occurrences of Dots by Positions Within the Braille Cell as Reported by Kederis, Siems, and Haynes

Occurrence	Dot Positions	Occurrence
583,487	1	
491,320	2	
499,690	3	
	4	453,028
	5	452,659
	6	303,298

at the level of which they are mentally capable. This is also seen through the rapid gains in reading achievement that often occur when an approach is modified or individualized.

As mentioned earlier, only four books have dealt with the subject of instruction in braille reading (Burklen, 1932; Maxfield, 1924; Lowenfeld et al., 1969; Nolan et al., 1969). Numerous journal articles and convention proceedings have provided additional coverage to the topic, but much of this has been concerned primarily with personal experience and observation.

After a series of experiments, Burklen (1932, p. 52) concluded that for the best braille reader, ". . . the position of the hand, arm, and body assumes special significance in touch reading; therefore, special attention must be paid to it." In addition, the fastest readers used both hands while using the index fingers in a straight running line and applying slight uniform pressure. Whereas both synthetic and analytic movements were considered a necessary part of tactual comprehension, faster readers had fewer analytic or exploratory movements.

Maxfield's (1928) book was the first comprehensive and educationally oriented handbook for teachers of braille reading. In order for students to develop the proper mechanics for braille reading, Maxfield made several suggestions: (a) general relaxation, (b) light touch or pressure, (c) fingers at a slant forming an acute angle with the line of braille, (d) use of both hands, (e) minimum up-and-down movement of the finger tips, (f) encouragement to read ahead on the next line with the left hand as the right hand finishes the preceding line, (g) correct posture, (h) book parallel or nearly so with the edge of the table, (i) elimination of lip movement and inner speech while reading silently, and (j) considerable practice in braille reading with consistent use of good braille mechanics (pp. 56-58). These recommendations, which were fairly consistent with Burklen's and those of the Uniform Type Committee, have generally been reinforced by other studies: Holland (1934), Fertsch (1946, 1947), and Eatman (1932). Holland and Eatman (1933) made moving picture records of the silent reading habits of their subjects in several studies. They discovered that up to 7 percent of total reading time in braille was spent in making return sweeps.

Maxfield found left hand readers to be the most efficient in contrast to Burklen's finding. After surveying the present procedures used for teaching braille reading in the United States, Lowenfeld et al. (1969, p. 118) recommended that allowances be made for individual differences in reading behavior. Because no statistically significant differences in comprehension and reading rate were found between students using the left hand, right hand, or both hands, individual preference was encouraged. In addition, Lowenfeld et al. stated that more than the index finger(s) should be used, and posture in reading did not appear to have any influence on reading efficiency.

A survey of 35 primary braille classes by the American Foundation for the Blind in 1926 (Maxfield, 1928) revealed that the introduction of braille reading could involve the letter method, the letterword method, or the word method. The letterword method was used by approximately half of the cooperating teachers, and a third of the teachers used the word method. The Lowenfeld et al. (1969) nationwide survey, which included all residential school programs and all elementary local school programs, was in contrast with the American Foundation for the Blind's 1926 findings. According to the 362 questionnaires which were filled out by 520 teachers, 64 percent of the replies indicated the use of the whole-word method, and only 36 percent introduced braille reading by the alphabet method (p. 46).

Two important factors have had an immeasurable influence upon the use of the whole-word method in the introduction of braille reading. Possibly the most influential factor has been the use of the regular basal reading series which were designed for sighted children. The Lowenfeld et al. study showed that

the two most used basal reading series in use in residential and local school programs for the visually handicapped were the Ginn Basic Readers and the Scott Forsman New Basic Readers (p. 55). Both of these basal series advocate the use of the whole-word approach (Chall, 1967). In addition, the braille code itself makes the whole-word approach necessary in the teaching of many words due to the whole-word contractions which consist of a single braille character.

Although the whole-word approach was found in the survey by Lowenfeld et al. to be the method most used today, it is possible that a more precise definition of the three instructional approaches to braille reading needs to be made.

Because of the inherent nature of the braille code, as opposed to the print alphabet, perhaps educators of blind children should not refer to various approaches to braille reading in parallel terminology with that of print reading. The results of the nine extensive studies reported by Nolan et al. (1969) showed that whole-word reading was not characteristic of the braille readers in their studies, but that the perceptual unit in word recognition was the cell. They further stated (p. 47) that ". . . the process of braille word recognition is a sequential integrative one in which word recognition is the result of the accumulation of information over a temporal interval from sensing the braille characters." It was revealed that the analytic approach became more necessary and thus required more time as familiarity decreased, contractions were included, the length of words were increased, and dot distributions were concentrated in the lower part of the various cells in words.

The Henderson (1967) study, which will be discussed in more detail later, tested the educational implications of the Nolan et al. findings. Evidence was subsequently provided which showed that training in character recognition can produce significant increases for elementary grade students in comprehension of silent reading, in oral reading speed, and in accuracy of oral reading. By contrast, Kederis, Nolan, and Morris (1967) found no significant effects on the reading speed of subjects who were trained in whole-word recognition. According to Nolan et al. (1969, pp. 50-51), "As the complexities of Grade 2 Braille are encountered, constant monitoring of character recognition skills and knowledge of code meanings seems critical." Educational responsibility demands that consistent attention be given to the results of these studies.

Harley (1969) reported the results of a pilot study concerning the comparison of teaching beginning reading through materials in Grade 1 Braille, Grade 2 Braille, and a phonemic braille patterned after the Initial Teaching Alphabet. In addition, one basal reader was tested which used the analytic approach, while another was tested using the synthetic approach to teaching reading. A longer study with more subjects and more adequate materials was deemed necessary before making any generalizations concerning the efficacy of approaches in braille reading.

An exploratory study using new materials was also conducted by Rex (1970). An analysis was first made of all braille contractions in four basal readers from preprimer level through the third grade. The contracted words were classified into five braille orthographic categories according to initial use, rate of introduction, frequency of appearance, and commonality of use. Using the information from the analyses, supplementary materials were developed for the basal readers based on the principles of linear programmed instruction. Sixteen experimental subjects received eight weeks of instruction with the basal reading series and the experimental supplementary materials. At the same time, eleven control subjects continued using the basal reading series with traditional supplementary materials. Three out of four criterion measures favored the experimental group on the posttest results, but on none of the measures was the difference in the scores of the two groups statistically significant. Additional studies such as this need to be encouraged over a longer training period than eight weeks.

ERRORS IN BRAILLE READING

Using the oral reading performance of elementary grade children, the most extensive analysis of errors in braille reading was conducted by Ashcroft (1960). The 728 subjects in his study were in grades two through six, and read 6,433 paragraphs containing 543,065 words. The 12 paragraphs used were graded for reading difficulty and designed to include the 185 signs, abbreviations, and contractions essential to the braille code. Each subject read successive paragraphs until he made ten or more errors. Only 12,108, or 41.6 percent, of the errors provided data for the qualitative analysis which contained the eight error-type groups shown in Table 2.

Seven categories were designated according to the type of braille orthography prescribed by the braille code for their presentation. Combinations of orthography, short-form words, and multiple-cell contractions included only 26 percent of the total number of words, but made up 46 percent of the total number of errors. Lower-cell contractions, upper-cell contractions, alphabet abbreviations, and full spelling contributed 74 percent of the words, but the errors attributed to these words made up only 54 percent of all the errors. The incidence of error, 5.3 errors per 100 words, was not considered to be excessively high. Ashcroft summarized recommendations for each of the eight error types and also for teaching methods and materials. Recommendations regarding revisions in braille code were also made.

An analysis of the oral reading errors by third through sixth grade level students was also made by Henderson (1967). Every error made by 24 subjects on both a pretreatment and a posttreatment oral reading measure was recorded and classified. Four types of errors were found to account for about 93 percent of the aggregate number of errors. Approximately 75 percent of the total number of errors were in the two categories of repetitions and substitutions, while omissions and insertions accounted for another 18 percent. The training in character recognition provided to the experimental group helped them decrease their total number of errors in oral reading by 28.33 percent as compared to a 11.9 percent decrease by the control group. The relative ranking of error types was not greatly effected by the treatment except that there was no change in the number of insertions from pretest to posttest.

Table 2

Percentages of Eight Types of Braille Reading Errors as Reported by Ashcroft

Problems of Perception	Percent	Problems of Orientation	Percent	Problems of Memory	Percent
Missed Dots	16	Reversals	13	Association Errors	12
Added Dots	13	Vertical Alignment	10	Gross Substitutions	12
Ending Problems	15	Horizontal Alignment	9		
Total	44		32		24

TRAINING TO INCREASE BRAILLE READING SPEED AND ACCURACY

The rate of braille reading has received considerable concern and attention in the research and literature: Burklen (1932), Hayes (1918, 1920), Merry (1932), Athearn, Campbell, and Lavos (1944), Niday (1959), Lowenfeld (1945), Meyers et al. (1958), Foulke, Amster, Nolan, and Bixler (1966), Lowenfeld et al. (1969), and Nolan et al. (1969). Although the average rate of touch reading is generally stated as two to three times slower than the average rate of print reading, there is a wide range of ability and reading speed among braille readers as shown in Table 3.

Flanigan (1966) reported the training of 15 junior high subjects for a total of 2100 hours on an automated self-learning device while 15 control subjects spent the same amount of time on traditional reading. Braille was introduced on a tape which moved from right to left across an exposed presentation window. Significant differences did occur in the rate of braille reading speed in favor of the experimental group on the posttreatment measure. After a three-month noninstructional period the experimental gains had remained constant with only minor exceptions. Motivation was an uncontrolled variable.

Table 3

Braille Reading Rates as Reported in the Research

Study	Mean wpm	N of *S*s	Grade Level
Meyers et al. (1958)	68	275	5-12
	63		5- 8
	86		9-12
	90	167	adults
Foulke et al. (1962)	57 (science)	21	6- 8
	70 (literary)	21	6- 8
Nolan (1966)	50 (science)	64	4- 6
	65 (science)	61	9-12
	51 (soc. studies)	68	4- 6
	74 (soc. studies)	53	9-12
Henderson (1967)	73 oral pretreatment	12	3- 6
	84 oral posttreatment	12	3- 6
Lowenfeld et al. (1969)	84 local school	50	4
	72 residential school	50	4
	149 local school	50	8
	116 residential school	50	8

Kederis et al. (1967) did not obtain significant effects with a controlled rapid exposure device or with a variable-speed pacing device. Both studies had an experimental and control group of 15 matched subjects with the experimental group practicing reading with their instruments for one-half hour daily for 20 consecutive school days. Motivation was controlled in both of these studies through monetary awards (p. 104): "The most important finding of the present studies was that stimulation of motivation to read faster resulted in remarkable reductions in reading times by all subjects." The average reduction in reading time of 24 percent showed that effects from motivation have tremendously important implications for education and for much needed additional research.

The most recent report on the use of a programmed machine-paced instructional device (Flanigan & Joslin, 1969) involved 13 subjects from third through ninth grades. Nine 15-minute periods were used to remediate the 17 characters of the alphabet which had presented the most difficulty in an earlier phase of the study. Thirteen control subjects received an equal amount of training with braille on thermoplastic film. Although a significant difference did result in the speed of perception of the braille characters as a result of training, the six word-per-minute (wpm) increase from pretreatment to posttreatment was not statistically significant.

Henderson (1967) conducted possibly the most educationally significant study on training to increase braille reading speed. Operating on evidence from several years of study by the Department of Educational Research of the American Printing House for the Blind, she investigated the educational implications of the conclusion (Nolan, et al., 1969) that the braille character is the perceptual unit in braille reading. Twelve experimental and 12 control subjects from grades three through six were equated on sex, mean grade, age, IQ, and reading achievement on a silent reading test. In recognition of the importance of the results of motivation in the Kederis et al. (1967) study, the silent reading test was administered under motivated conditions to obtain optimum performance. The experimental subjects were given one-half hour of practice on 18 consecutive school days while the control subjects remained in their traditional reading programs. Training materials consisted of 20 lists of randomized orders of the 55 single-cell braille characters, parallel forms of three kinds of discrimination exercises using the 55 single-cell characters, and individual review cards of each of the 55 characters. Prescribed lesson plans were followed and daily records were kept for each subject on his reading time and errors. Each day the subject was informed of his performance, to motivate him to improve over the previous day's performance. Pretreatment and posttreatment measures provided data on rate and accuracy of character recognition, rate and accuracy of oral reading, and rate and comprehension of silent reading. When compared with the control group after training, the experimental group showed statistically significant decreases in errors and time for character recognition. Significant differences were attained in oral reading as the oral reading rates were increased by 15 percent. A 28 percent decrease in errors occurred on the oral reading test. Although almost one-half of the experimental subjects increased their silent reading rate and their silent reading comprehension for educational gains, these gains were not statistically significant. It was suggested that the results of the posttreatment silent reading test might have been adversely affected because of overstimulation due to the monetary awards.

BRAILLE READING AND BRAILLE TESTS

One of the primary reasons why reading procedures are so seldom evaluated, and why reading performance is not more often and more carefully analyzed, is the scarcity of reliable and valid instruments on which to base judgments. Standardized testing of braille reading has been done almost entirely through special adaptations of instruments designed for ink print readers. The adaptations have not necessarily included adequate validation or standardization of the tests

in their braille form. Because of the slower braille reading rate mentioned earlier in this review, the braille reader has often been allowed up to a 2-1/2 times greater period of time to complete some tests than his sighted peer.

Measures of an individual's knowledge of the braille code have been fairly recent. The 12 oral reading paragraphs developed by Ashcroft (1960) mentioned earlier, represent the first diagnostic instrument for the evaluation of braille errors. The graded reading difficulty required for Ashcroft's study, limits the use of the paragraphs to the reading level of the elementary grades.

The Lorimer Braille Recognition Test (Lorimer, 1962) was developed in England and consists of 174 unrelated words arranged in the form of a word-recognition test. Standardized on a total of 332 students, norms are provided for each one-half year of chronological age from 7 years to 13 years. The Tooze Braille Speed Test (Tooze, 1962) was also developed in England and consists of 120 three-letter words which contain no Grade 2 contractions. The words were selected to avoid those words which might present vocabulary trouble. Norms were established on 135 students from 7 to 13 years of age. The primary purpose of the test was to provide a quick appraisal of a student's ability to read the braille characters.

Woodcock and Bourgeault (1962) developed and standardized the Colorado Braille Battery, a set of 11 tests which provide an objective measurement of a student's overall knowledge of both the English Braille literary code and the Nemeth code for mathematical notation. The seven tests of the literary code consist of a pretest and two alternate forms of three tests: Beginning Level, Intermediate Level, and the Advanced Level. The three levels overlap to provide for braille readers considered to be between levels. The Literary Pretest is a screening device of 13 items designed to determine which of the three levels the subject should receive first. Norms were based upon 2203 students in grades 1 through 12 in 19 residential schools and 43 public school programs for the blind. Except for Ashcroft's paragraphs, none of the aforementioned instruments provide information on the diagnostic use of the tests in their respective manuals.

Hanley (1965) constructed a Diagnostic Perception Test which provides a profile of errors according to specific types of misperceptions and categories of braille orthography. Two forms of the test isolate and categorize the types of perception errors which are peculiar to the 215 English Braille letter, part-word, and whole-word symbols. Matching with aid, matching without aid, recognition, identification, and reproduction were the five modes of presentation which were used on each form of the test. Each subject was required to identify a given symbol from eight possible choices, with seven alternative choices representing specific kinds of perception errors. In a pilot study of the instrument 192 subjects were evenly divided according to grade level, sex, residential or public school, and alternative forms of the test. Reliability coefficients for all five levels on both forms ranged from 0.957 to 0.979 on the Diagnostic Perception Test, which has not yet been published for distribution.

SUMMARY

Considerable attention needs to be given to research on touch reading. The preceding review of the literature and research reveals that further research consideration needs to be given to the following areas:

1. Diagnostic tests which provide information on achievement level in braille reading and which also designate the areas which are in need of remediation should be developed, evaluated, and published.

2. Instructional approaches to braille reading which are based upon needs specified by the inherent nature of the braille code should be investigated, rather than merely following the

current practices or needs of print readers.

3. Instructional and remediation materials which appeal to specific reading problems inherent in the braille code need to be developed and evaluated.

4. The findings of Nolan et al. (1969) should be extended to investigate the relationship of perceptual factors in braille-word recognition to initial reading instruction and subsequent reading ability.

5. Further exploration is needed in the importance and effects of motivation and attitudes upon the reading achievement of students. Special attention should be given to the relationship of motivation and intelligence levels as suggested by the findings of Kederis et al. (1967).

6. Additional investigation is warranted on the use of programmed instruction and teaching machines.

7. The effects of instructional programs in braille writing should be explored (Morgan, 1969) as one way of insuring accurate use and knowledge of the code and rules governing its use.

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COMPARISON OF SEVERAL APPROACHES FOR TEACHING BRAILLE READING TO BLIND CHILDREN*

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Abstract

The present study was undertaken to develop and field test materials to be used in a large two-year study to compare six approaches in teaching braille reading to blind children. Materials in two braille media--grade 1 and phonemic--were developed and tested along with the traditional grade 2 system in two basal readers using contrasting approaches, analytic and synthetic. The 39 subjects were located in six classes in six residential schools for the blind.

Visual acuity ranged from 20/200 to total blindness and chronological age from five to ten years. Intellectual ability of the subjects as measured by the Interim Hayes-Binet ranged from mildly retarded to high average, but there were no significant differences in mental age among the four groups used in the final analysis. The grade 1 groups were not compared due to possible unreliability of reading scores from one of the groups.

Special books were embossed in grade 1 and phonemic braille. Special phonemic codes were prepared for use with the analytic and synthetic readers.

Teachers were prepared in a three day workshop preceding the start of the school program. The experimental materials were introduced to subjects following a readiness program in each group. A daily progress record was kept by each teacher, and periodic reports were made of special problems encountered in the use of the reading materials. Teacher reactions were used in the evaluation of each approach.

Results of the Slosson Oral Reading Test and the Gilmore Oral Reading Test administered at the end of the academic year indicated that phonemic braille could be used successfully with these beginning braille readers. The analytic approach appeared to function more effectively for the phonemic materials than the synthetic approach. The effectiveness of the grade 1 approaches was not adequately measured. A study of longer duration with more subjects and more adequate materials is necessary to make generalizations concerning the efficacy of approaches in braille reading.

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PROBLEM

The overall purpose of this investigation was to determine the most effective approach to the teaching of beginning reading to blind children. During the pilot study, or period of this report, materials in three braille media--grade 1, grade 2, and phonemic--and two basal readers using contrasting approaches were to be prepared and studied for use in a more extensive study with a larger sample.

An examination of the literature reveals a paucity of research in the study of approaches to the teaching of braille reading to blind students. One approach is being used in

education of blind children which was actually adopted by consensus without proof of its effectiveness. Research has been conducted to investigate the most effective approach in teaching reading to normal children. It seemed appropriate that a study should be made to examine the effectiveness of several unique approaches to the teaching of braille reading to blind children.

REVIEW OF RELATED RESEARCH

There is very little research to indicate that the present mode of teaching braille reading to blind children by starting with grade 2 is the most effective procedure. Ashcroft (1960) has noted that the space saving efforts used in grade 2 braille contribute substantially to the reading difficulty encountered. These features included such factors as assignment of several meanings to the same braille symbol, extensive abbreviation of words and the use of contractions to represent from one to five letters with from one to two symbols. A first grade blind pupil must learn most of grade 2 in order to read the present first grade books that are embossed in braille. Hooper (1946) noted in a study of 21 series of reading books that the majority of signs, abbreviations, and contractions of Standard English Braille were employed in the reading vocabularies of children in the first grade of school.

Although insufficient research was done to give positive justification to the shift to grade 2, the shift was made gradually against the wishes of some of the profession. Langan (1950) reported results of an opinion survey of teachers which indicated considerable disagreement concerning the level at which grade 2 braille is best introduced; whether to eliminate the progression from grade 1 through grade 1-1/2, and then into grade 2. Irwin (1955) indicated that the adoption of grade 2 for primary children was resisted at first but was gradually extended downward into the lower grades by the American Printing House for the Blind until in 1950 few books except for children in the first grade were published in grade 1-1/2. Ashcroft (1960) indicated that the schools and classes in the nation have moved solely to the use of grade 2 braille without any conclusive research to indicate that this method was better than any other method.

The Illinois Braille Series (1963) is used with newly blinded adults in several rehabilitation centers. This series starts with grade 1 (alphabet) and proceeds to grade 2 (highly contracted) using some books in grade 1, some in grade 1-1/2 (moderately contracted), and some in grade 2. This series, now available from the American Printing House for the Blind, has been used both with adolescent and adult learners.

The results of research with blind children by Nolan, Morris, and Kederis (1965) indicated little resemblance between the dynamics of the braille reading process to those of print reading. They reported that although print reading involved the perception of large wholes, braille reading consisted of a sequential integrative synthesis of the dots. It was found that contracted braille words were generally more difficult to recognize than uncontracted words. The results indicated that increasing the number of contractions in a word adds to the difficulty of recognition. A synthetic approach to teaching of reading might be indicated by the results of this series of studies.

Lowenfeld, Abel, and Hatlen (1969) found considerable uniformity of reading methods among teachers of blind children in residential and day school programs. They found that two-thirds of the teachers started with the word or sentence method whereas one-third of them began braille reading instruction with the braille alphabet. However, many teachers using the alphabet method switched to the word method soon after the letters were learned. Ninety-six percent of the residential schools and 94 percent of the local schools used braille grade 2 from the beginning.

An elemental approach in teaching reading to the educable mentally retarded has been recommended by Dunn (1963). He recommended a sequence of steps in this order: "Listening comprehension for

instruction and stories, auditory discrimination of familiar sounds and then speech sounds, sound blending ability, visual discrimination for individual letters, association of sounds with individual letters, word-attack skills." In a study of mentally retarded and mentally normal boys of the same age, Dunn (1954) found that the mentally retarded group was deficient in the use of phonetic word attack skills and in the speed of recognition of words and phrases. A study by Woodcock (1967) was conducted to compare the efficacy of several approaches for teaching reading to young educable mentally retarded pupils in which a phonemic alphabet was used as one approach. No significant differences in reading achievement were noted among any of the approaches at the end of two years of the study.

DESCRIPTION OF APPROACHES

Three selected braille media for the teaching of reading to blind children were demonstrated and evaluated. These media were grade 1, grade 2 and phonemic braille.

Grade 1 braille is currently being used with newly blinded adolescents and adults. The braille equivalents for the 26 letter alphabet (grade 1) are first introduced. Later, selected space saving forms are introduced. Finally, all of the abbreviations and contractions of grade 2 braille are learned (Illinois Braille Series, 1963).

Grade 2 braille is now being used with blind children. All basal readers produced at the American Printing House for the Blind are produced in grade 2 braille. Contractions, abbreviations and whole word forms are introduced immediately. Books are copied into braille directly from print editions without any adaptations allowing for planned introduction of the special braille forms.

A phonemic alphabet, ITA, was developed in print by Pitman (Downing, 1964) using the augmented Roman alphabet. This approach, which uses a phonetically consistent 44 element alphabet, is a two-state approach to the teaching of reading. The child first learns to read and write using the basic 44 characters. After learning to read and write these symbols, he makes a transition to reading words constructed with the traditional 26-letter alphabet. A phonemic alphabet offers certain advantages over traditional orthography in print. Letters always have the same shape and sounds and written symbols have a consistent relationship. In braille, letters always have the same shape (capital letters are made by prefixing the braille letter with a "capital dot" symbol). The advantage of a phonemic alphabet in braille is consistency in sound-to-symbol relationship.

In order to conserve space, braille symbols have been assigned multiple meanings which depend on position within the braille cell, and on the context of the symbol in the reading material. Contractions may stand for from two to five letters. Abbreviations and symbols for whole words add to the complexity of the problem. A comparison of grade 1, grade 2, and a phonemic alphabet (ITA) is illustrated in Table 1.

Two contrasting reading series were used in each approach so that one approach would not be favored by the selection of the reading series. Scott, Foresman's *The New Basic Readers Curriculum Foundation Series* (Robinson, Monroe, and Artley, 1965) had been used with blind children. This series stresses the gestalt or learning of whole word forms followed by introduction of basic word-attack skills during the readiness program. The emphasis on instantaneous perception of words requires the habit of instant association of sound and meaning with the word forms whose configurations must be learned. The building of a "sight" vocabulary is felt to be important in making progress in reading.

Lippincott's *Basic Reading* series (McCracken and Walcutt, 1963) was chosen because it stresses a systematic and orderly approach to reading using mechanical "decoding" skills. Stories are arranged so that they contain only words with the selected letter-sounds. This series stresses the use of the common phonics of English spelling from the beginning. Exceptional words with

Table 1

A Comparison of Grade 1, Grade 2, and ITA (a Phonemic Approach)

Total Signs		
	Grade 1	
46	The foundation of the fountain is really very strong.	
	Grade 2*	
26	The foundation of the fountain is really very strong.	
	ITA*	
34	The foundation of the fountain is really very strong.	

*The curved line under groups of letters indicates substitution of a braille symbol.

"unphonic" spellings are introduced after words with phonic spellings have been learned.

OBJECTIVES

The general objective of this three-year study was to obtain evidence regarding the most effective approach to teaching beginning reading to blind children.

During the pilot phase, the period covered by this report, the study was designed to:

1. Develop and field test materials for comparing grade 1 braille, grade 2 braille, and a phonemic braille, using a synthetic and an analytic type basal reader
2. Develop a manual of procedures to guide the teaching of reading in all approaches.

After the conclusion of the pilot study, a demonstration phase of two years with a much larger sample would provide more opportunity to evaluate and compare the efficacy of the reading approaches.

METHODS

Sample

Table 2 shows the schools participating in each method and the number of children who completed the academic year in each experimental class.

In three of the classes the teachers worked exclusively with children in the experimental group, but in three of the schools the teachers also had other pupils using a different reading mode. In both the Virginia and Tennessee schools the teachers had other pupils reading in large print. In Virginia the large print readers were not using a phonemic alphabet as were the braille readers. In Tennessee, the large print readers had no symbol system identical to the standard grade 2 braille code. In Kentucky, there were children repeating first grade work who were continuing to use the grade 2 braille text books that had been introduced to them the previous year.

Visual Acuity. Visual acuity ranged from 20/200 to total blindness.

Table 2

Participants in Peabody Beginning Braille Reading Project

Number of Children Completing School Year

Series	Phonemic School		Grade 1 School		Grade 2 School		Total
Scott, Foresman	GMS[1]	8	KSB[2]	4	TSB[3]	4	16
Lippincott	VSDB[4]	4	MDSB[5]	11	MOSB[6]	8	23
Total		12		15		12	39

[1] The Governor Morehead School, Raleigh, N.C.;
[2] Kentucky School for the Blind;
[3] Tennessee School for the Blind;
[4] Virginia School for the Deaf and Blind;
[5] Maryland School for the Blind;
[6] Missouri School for the Blind.

No data was available concerning near visual acuity, but in each case the school had designated the child for braille instruction. Table 3 indicates that 20 children, or a little more than half the sample, had no greater remaining vision than light perception.

Table 3

Reported Visual Acuity of Subjects

Acuity in the Better Eye	Number
Nil	12
Light Perception	8
Hand Movements	1
Counts Fingers, 4" - 5"	6
2/200 - 5/200	2
5/200 - 10/200	0
10/200 - 20/200	6
Undetermined (little)	1
No Information	2

The largest single primary cause of blindness among the participants was retrolental fibroplasia. The incidence of seven cases in the past years was higher than expected in a first-grade population. Glaucoma, cataracts, optic atrophy, and retinitis pigmentosa were also represented in the group. Other causes were varied as indicated in Table 4.

Table 4

Primary Cause of Visual Impairment among Subjects

Primary Cause	Number
Retrolental Fibroplasia	7
Glaucoma	4
Cataracts	3
Optic Atrophy	2
Retinitis Pigmentosa	2
Displasia of Optic Nerves	1
Retinal Degeneration	1
Amblyopia	1
Not Reported	8
Trauma	1
Macular Degeneration	1
Chorioretinitis	1
Hydrocephalus	1
Microphthalmos	1
Astigmatism, Nystagmus	1
Pigmentary Degeneration	1
Nystagmus, Esotropia	1
Hypermetropia, Ocular Nystagmus	1

Prior School Experience. Braille reading is introduced after a year of kindergarten in five of the schools. In one of the schools reading is introduced in the first

year to mature pupils, but most children are introduced to braille reading after a year in a kindergarten program.

The amount of prior exposure to educational programs varied widely among the children. Experience included nursery school, kindergarten, Headstart, and day-school program. Also included were the residential school kindergarten and programs for multiply-handicapped children. Prior school experience varied from no prior experience for 11 children to more than two years of residential school kindergarten for one child as noted in Table 5.

More than one-half of the subjects had participated in some type of educational experience prior to being placed in the beginning braille reading class. Children with the longest periods of readiness would presumably be those children with the least ability to master reading skills. Records indicated that some children had entered kindergarten after their sixth birthday.

Age of Participants. Considerable variation was found in age range as seen in Table 6. The subjects included one five-year-old child and three ten-year-old children although most children were about six to eight years of age. The overall median age 7.7 years was very close to the median age for each group. The highest median age, as well as the largest number having chronological ages over ten, was found at the Missouri School for the Blind which used the Lippincott series in grade 2 braille.

Preliminary Tests. Arrangements were made for the Interim Hayes-Binet Intelligence Tests for the Blind (Hayes, 1942) and the Roughness-Discrimination Test (Nolan and Morris, 1965) to be administered during the first quarter of the school year. The research associate gave the tests to subjects in two schools while local psychologists who were familiar with the school programs administered these tests in the other schools.

The tested intellectual ability of the children ranged from mildly

Table 5

Prior School Experience of Pupils

Type	Lippincott				Scott, Foresman				Grade Total
	Gr.1	ITA	Gr.2	Total	Gr.1	ITA	Gr.2	Total	
No prior experience	3			3	2	3	3	8	11
Nursery school			4	4					4
*Local school program	2	1	1	4		3		3	7
1 yr. residential school kindergarten	6	4	1	11	1	1		2	13
2 yrs. residential kindergarten	1	1	6	8	1	1	1	3	11
More than 2 yrs. residential kindergarten			1	1					1

(Some children may be listed in both nursery school and kindergarten.)

*Includes public and private kindergartens, Headstart, and programs for the multiply-handicapped.

Table 6

Ages of Pupils Participating

Chronological Age (Years) as of 9/1/67	Number in Class								Grand Total
	Lippincott				Scott, Foresman				
	Gr.1	ITA	Gr.2	Total	Gr.1	ITA	Gr.2	Total	
5.5 - 5.9	1			1				0	1
6.0 - 6.4	2	1		3				0	3
6.5 - 6.9	2			2		1		1	3
7.0 - 7.4	1			1	2	2	2	6	7
7.5 - 7.9	3	1	2	6		1	1	2	8
8.0 - 8.5	2	1	2	5	1	4	1	6	11
8.6 - 8.9		1	1	2				0	2
9.0 - 9.5				0	1			1	1
9.6 - 9.9				0				0	0
10.0 - 10.5			3	3				0	3
Total	11	4	8	23	4	8	4	16	39
Median	7.2	7.95	8.55	7.7	7.7	7.45	7.45	7.7	7.7

retarded to high average. IQ scores attained with visually handicapped children may not accurately reflect innate potential to deal with academic school materials, but experience with these tests indicates that the child's functioning level at the time of administration is usually represented by his test performance. One subject did not respond to testing sufficiently well to attain an IQ score, but he was retained in the experimental reading group due to adequate classroom performance. Although some of the scores were relatively low, classroom performance indicated that these pupils were ready for beginning reading.

The mean IQ for all of the children was 82.667 (Standard deviation = 18.359). The mean IQ for boys was 81.091 and for girls, 84.706. The difference between boys and girls was not significant ($-t$ = .605).

The children using each textbook series were compared with the other. A Mann-Whitney U test yielded a Z score of 1.450 (p = 0.0735) which was not statistically significant (Siegel, 1956).

In one group the teacher expressed some doubt that the test results were an accurate measure of the actual level of ability of one subject. Her judgment was verified when this child mastered reading by the end of the year with a degree of proficiency that would have been most unlikely at the tested IQ.

The Roughness-Discrimination Test has been demonstrated to have some predictive validity for beginning braille reading (Nolan, 1960; Nolan and Morris, 1965). It consists of a series of cards with sandpaper of different grits, three on each card being the same and one being

Table 7

Interim Hayes-Binet Intelligence Test Scores

IQ	Number by Test Series and Reading Method: ITA SF	ITA L	Gr.2 SF	Gr.2 L	Gr.1 SF	Gr.1 L	Total
106-115	1	2					
96-105	1		2			1	
86-95	1	1	2	2	1	3	
76-85	3	1		2		4	
66-75				1			
56-65				2			
Untestable				1			
Median	88.5	99.0	97.0	70.0	83.5	77.0	84.0

different. The difference between the texture of the single block unlike the others varies from gross to fine. The test yields a measure of ability to discriminate tactually.

Many of the children showed a tendency to give stereotyped responses on the Roughness-Discrimination Test or no responses at all. This can be seen by the large number of low scores shown in Table 8.

Table 8

Distribution of Roughness-Discrimination Scores

Score	Children
61 - 70	1
51 - 60	7
41 - 50	13
31 - 40	7
21 - 30	3
Below 20	8

The mean for the group was 36.289 and the standard deviation was 19.388. When the sexes were compared, the boys' mean was 41.300 (sd = 13.174) and the girls', 30.722 (sd = 23.701). The difference did not prove to be statistically significant (t = 1.728).

Since a sizeable number of subjects from one class did not respond adequately to this test, the test results were of little value in making comparisons between reading groups.

Preparation of Materials

The materials were prepared in braille for each approach. Preprimer, primer, and first reader books were available in grade 2 braille from the American Printing House for the Blind. Books in grade 1 braille were easily embossed for the project at Howe Press. Books in phonemic braille were much more difficult to prepare. A Scott, Foresman series was already available in ITA in print (Robinson and others, 1965). A braille code was developed to match the ITA symbols (Appendix B).

Some symbols such as the *ch*, *wh*, *th*, and *sh* were taken directly from grade 2 braille contractions. The adaptation of a phonemic alphabet into braille required some

additional symbols for sounds that were not represented in the braille code. Other symbols were adopted arbitrarily such as the dot 4 preceding a vowel indicated a long vowel sound, whereas the vowel standing alone indicated a short vowel sound. Forty-four sound symbols comprised the completed phonemic braille code. No symbol was employed which would be encountered with a different meaning after the pupil made a transition to grade 2 braille.

The Lippincott Series was not available in an ITA code in print. The 44 phonemic braille symbols were assigned to the words in this series by using dictionary pronunciation. *Webster's New World Dictionary Elementary Edition* (Guralnik, 1961) was used for each word in the Lippincott series. For example, "cheese" was marked "chez." The braille phonemic symbols for *ch*, long *e* and *z* sounds were used in the transcribing process. The whole word signs *a*, *and*, *for*, *of*, *the* and *with* were used as whole word signs as in grade 2 braille. No other contractions were used other than the contractions representing phonemic sounds in the new code. Several modifications were made such as the grade 2 braille contraction for *ing* which was used to represent all *ng* sounds. A dot 4 *th* was used to represent one of the two phonemic *th* signs.

Preparation of Teachers

Six experienced teachers of beginning braille readers served as demonstration teacher-consultants in the pilot study. These teachers, located in residential schools for the blind in Kentucky, Alabama, Missouri, North Carolina, Tennessee, and Virginia, participated in a three-day workshop in July of 1967 to develop principles to be used in all reading approaches in the study. They reviewed the two chosen textbook series, examined the available teaching guides and texts, and reached some conclusions concerning the teaching approaches. Reading specialists from George Peabody College for Teachers described a number of different methods of teaching beginning reading. They discussed symbol systems currently employed in establishing experimental teaching programs for beginners and explored reasons for the choices of materials made in this study.

The modifications in the experimental braille codes were explained. Braille specialists discussed general procedures for teaching punctiform reading.

The teachers and research staff explored possible areas of difficulty, testing procedures, information needed about pupils, report forms for individual pupils, and lesson plans. Some general agreements were reached by the group in regard to certain teaching procedures. All agreed to introduce writing along with reading rather than waiting until pupils had acquired some degree of skill in tactual reading.

Selection of groups to use each approach was not random. In some cases school administrators had previously expressed a preference for having a particular approach tried in the school. Teachers from the various schools also agreed among themselves as to preferences of textbook series and symbol system.

Teacher Observations

Each teacher maintained daily records for individual pupils and for teaching activities. A copy of this report form is in Appendix V. Information was requested concerning individual and group readiness activities, introduction of braille symbols, introduction of words, other beginning reading activities, mastery of writing symbols, and any parallel activities which contributed to the beginning reading program. A progress report on each child and a summary of the overall program were prepared. After evaluation of the effectiveness of the report forms at the end of the first month, daily reports were maintained but only quarterly reports for the pupils and the teacher were submitted during the remainder of the project. Along with the quarterly report forms, teachers also sent samples of materials prepared for use with students and some samples of pupil work. A copy of the quarterly report form is in the appendix.

Methods of Analysis

Results were analyzed in two ways. Teachers provided evaluations of teaching procedures, experimental materials, and pupil progress. These evaluations were studied and summarized. Results of the Slosson Oral Reading Test and the Gilmore Oral Reading Test administered at the end of the year were compared for each approach, considering IQ scores and using a 2 x 3 analysis of variance with appropriate *t* tests if warranted (Walker and Lev, 1953).

The Gilmore Oral Reading Test (Gilmore, 1952) was individually administered by teachers to all subjects in each group at the end of the year. This test, which consists of a number of paragraphs to be read aloud and timed, provides a measure of accuracy of oral reading and comprehension of material read. Speed of reading was not measured in this instance.

The Slosson Oral Reading Test (Slosson, 1963) was also administered by teachers to each subject at the end of the year. This test measures skill in reading isolated words rather than words in context. All can be administered very quickly to children in grades 1 to 8.

CLASSROOM PROCEDURES AND TEACHER REACTIONS

Since the teachers from five schools had helped to choose the approach they preferred during the summer conference, a considerable amount of enthusiasm was generated. One teacher began working in the program after the beginning of the school year, but was interested in the approach and textbook used. Records were maintained on a daily basis for each pupil's activities in reading and the teacher's lesson plans. Teachers were enabled to evaluate individual progress on the basis of relatively complete written records.

In every class, teachers prepared adequate supplementary material for teaching reading. The four groups who were using the phonemic codes or using grade 1 braille prepared all supplementary reading materials since no other materials were available.

All teachers displayed considerable skill and ingenuity in devising activities, games, etc., used to interest children and to develop the tactual and auditory skills that would enhance braille reading.

Each quarter every teacher completed a summary showing activities used during that time, reporting on group progress in developing specific reading skills, analyzing problems encountered, etc. Similarly a report was prepared for each child giving information about his readiness activities, acquisition of new symbols and words, number of books introduced, writing of symbols, and specific problems encountered in reading and writing.

Readiness

In preparing children for beginning reading during the first quarter and for new material introduced at each stage of the reading program, a variety of different primary teaching techniques were employed. Many of these were adapted from those normally used in any first grade program. Suggestions in the teacher's manuals for the particular textbook series were sometimes used with needed modifications. Other activities were specifically devised for the particular class and the observed needs of the group and individuals in the group.

Hand and finger manipulatory capacities were trained through numerous games. Tactual exploration of materials was stressed. Every class used the *Touch and Tell* books (Duncan, 1957) available from the American Printing House for the Blind. Puzzles and manipulatory toys for primary age children were utilized in addition to individual materials prepared by the teachers. Children were given such tactual paper materials as sheets with raised lines in order to learn to follow a line of dots, and cards with exercises in matching symbols. Later words and phrases were similarly presented.

In beginning the year such concepts as up-down, top-bottom, left-right, large-small, and big-little were taught or reviewed. These concepts were then stressed specifically in relationship to single sheets of braille material and braille books. Children were oriented to the idea of quiet work periods as well as group work and play.

Rhythm games, stories and story telling, and listening to records and tapes were important in developing listening skills. Listening activities became increasingly important in building readiness for new stages of the reading programs as these were introduced. Field trips broadened concepts and vocabularies. For visually impaired children who have often had rather meager chances to explore objects or places outside the scope of the home, field trips were important in giving concrete association for concepts in the reading materials.

In addition to tactual materials, children with even minimum vision were exposed to such visual aids as filmstrips and transparencies. Through these means it was possible to enlarge pictures and forms on a screen and encourage any child with residual vision to trace these tactually. Some students with only a minimum idea of light and dark found themselves able to follow a broad dark outline on a lighted screen with their fingers, thus gaining some idea of the pictured form.

The element of sound recognition was stressed more in the Lippincott than the Scott, Foresman books, but the ITA edition of the Scott, Foresman series necessitates consciousness of phonemes. All of the classes, however, did introduce phonics in teaching programs and utilized sound games throughout the year to familiarize the children with the associations between sounds and letters and words.

After the first weeks of school the children were well oriented to the new situation and had established good rapport with the teacher as well as among themselves. The readiness program was directed toward preparing the children for the specific unit activities.

Supplementary Material and Exercises

Every teacher prepared letter cards, word cards, and braille strips with short phrases and sentences. In the beginning of the reading program before any new words were encountered in context, they were presented on word cards. Particularly at first, the teachers prepared the cards with clues to orient the children to the card position so that the word or phrase could be read accurately.

Thermoformed materials were used extensively. The Scott, Foresman work books (Robinson, Monroe, and Artley, 1965) were adapted and brailled by the teachers using this series so that the children could use them. The teachers using the Lippincott books also used the Teacher Manuals in presenting new materials. Children were given brailled words, symbols, etc., to match on cards and on work pages. They were shown how to find and mark items on brailled pages as instructed.

In some of the classes, the children did not seem able to cope with a braille copy of the textbook as soon as they were ready to begin reading some of the content. In these cases, teachers prepared individual pages for the child to read and then bound these into booklets that could be taken to their cottage and homes. The children like having such booklets as personal possessions.

Simple three-dimensional objects were outlined on cards, identified by the children, and used to match with letter cards. To exploit every bit of residual vision, one teacher found that making transparencies from the work books enabled her to project visual materials to meet the needs of individual children. She could vary the distance and size of the picture for children who could not see them in the print text. Coupling these materials with brailled adaptations of the text, the children could follow activities suggested in the work books. Three-dimensional objects were prepared to illustrate beginning sounds and made into booklets in some classes. Alphabet boards and various kinds of chart boards were devised.

Recorded sound drills available from a number of commercial sources were employed in addition to other classroom drills to help students increase awareness of the relationships between sounds and symbols in both writing and reading exercises.

Problems Related to New Materials

Whether using grade 1, grade 2, or ITA symbols, certain children in each class had difficulty discriminating certain braille letters. Letters commonly found difficult to differentiate by some children in each group were: *D*, *F*, *H*, and *J*, *E* and *I*. An examination of the braille alphabet will show that these symbols in braille are mirror images or "up-down" reversals of each other.

Other problems were related to the particular form of braille code or symbol system. In grade 1 braille, the children found it difficult to differentiate words of similar shape and length. Some words that have distinctly different shapes and length in grade 2 braille are made to look similar by grade 1 coding. For example, children found that such words as *this*, *the* and *that* were difficult to distinguish. In grade 2 braille, these particular words would have each been represented by a single sign. *What* and *want* were other similarly shaped words misread by some of the children.

Children using ITA materials experienced some reversal problems with such symbols as *U* (⠥) and *M* (⠍). Some of the new symbols made for uneven spacing patterns which at times caused the children to misread the word. In grade 2 braille, some of the signs were confused by the children. Just as *E* and *I* are sometimes mixed up, *en* (⠢) and *in* (⠔) are similarly reversed. Other signs that created difficulty were *of* (⠷) and *with* (⠾), *and* (⠯) and *you* (⠽). When the children making the transition to grade 2 from ITA encountered the lower sign for *to* (⠞), they experienced difficulty in recognizing it.

The grade 2 material in the Scott, Foresman series presented relatively few problems for the children that teachers mentioned, but a number of the children lacked basic concepts needed to utilize the Lippincott series to best advantage. It is difficult to interpret such words as *arab*, *blimp* and *bog* to visually impaired children. Since a picture cannot be used to explain the word quickly, it requires more ingenuity and explanation to give these children associations to make some of the words meaningful. These children also encountered difficulties dealing with the concepts needed for homonyms such as *bail*, *bale* and *deer*, *dear*.

The grade 2 material in both series was more difficult because in transcription of print books into grade 2 braille at the primer level the introduction of braille signs was not systematic or planned.

The synthetic approach of the Lippincott series presented some special difficulties. For example, the word *went* followed *wet*, *bent* followed *bet*. Since *en* is somewhat difficult for the children to recognize, it presented a particularly difficult problem distinguishing these words from one another. The only time they encountered the *com* sign was in *come* or the *sh* sign was in *she*. The low frequency of occurrence did not provide sufficient reinforcement. *For* was introduced in *forest* and then did not reappear for over 50 pages.

Another source of confusion in the Lippincott grade 2 materials was finding singular forms in the word list, but having to read plural forms in the story. In the singular form all of these words are contracted, but in the plural, they are spelled out. At times when a particular sound is being demonstrated in a lesson and one of the words in braille appears as a sign, the child has no clue to the word. For example, on the *ar* page, the word *part* appears, on the *ai* page, *again* and *paid*, and on the *B* page, *but*. All of these examples have symbols in grade 2 braille making it necessary for the child to assimilate both a new phonics rule and several new braille signs at the same time in the same lesson.

Additional Problems

Limited transitional time was a problem for the four groups using grade 1 and ITA. In neither of the grade 1 braille classes was there time to make the transition to grade 2 braille. In the ITA groups, the teachers felt that it was necessary to set up a date to make the transition regardless of whether or not it was best for the individual child. The desirable time to make the transition would vary from child to child.

Preparation time of supplementary materials by the teachers in the experimental groups was also quite extensive. In addition to the supplementary materials that would normally be made up by the teacher, every paragraph or book read other than the textbooks had to be brailled by the teacher. Before the program is projected for other classes, some supplementary materials should be prepared. While other children could go to the library and get books from time to time, or could compare work in the cottage with one another, those using grade 1 and ITA were not in position to do these things.

Teacher Evaluation of Approaches

Three groups in particular found a considerable degree of responsiveness among the children. Those children using the regular grade 2 editions, Lippincott series, available from the American Printing House for the Blind made greater progress in reading than could have been predicted on the basis of their prior test performance. The children using the regular grade 2 editions of the Scott, Foresman series were also reported to have enjoyed their reading very much and to have made very satisfactory progress. In the Scott, Foresman series ITA group, the teacher observed that all children seemed to have developed a much greater degree of independence in reading and to have spent more time reading voluntarily than she normally encountered. The teachers reported that all of the classes were highly motivated.

In the ITA Lippincott series class, two children made good progress, but two of the children had difficulty. These latter two had more trouble with discriminating sounds and were less oriented toward sounds in relation to words. With only "sound" clues to help identify words and symbols, these children found the program more difficult and had less reading success. To quote the teacher: "I feel very strongly about this method of teaching reading. For those children who have an ear for sounds I could not imagine any other way of teaching reading. But, if a child cannot hear and use sounds, then this is not the method for him."

In the two classes which used grade 1 braille, progress was reported to be slower than in any of the other groups. The teachers felt that the approach was very difficult for the slower and immature children.

The early introduction of writing seemed to be desirable to all of the teachers. The two groups using ITA reported that the children were able to write words as soon as they had learned the symbols associated with the sounds in the word. The one strong point mentioned for beginning with grade 1 braille was that the children seemed to be somewhat better spellers than children who started with grade 2 braille when performance at the same point in the school year was compared. Writing and reading reinforced one another.

The analytic ITA group developed a higher degree of reading and writing independence earlier than other groups. They enjoyed their work and liked to experiment with writing new words as soon as they learned new sound symbols. The children seemed to experience fewer frustrations with beginning reading than is normally seen. Word attack skills developed in a programmed rather than a haphazard fashion.

Many of the difficulties encountered with introduction of braille signs in grade 2 braille are avoided with the ITA approach. When ready to make the transition, the children did not seem disturbed by the change to grade 2.

The two schools using the ITA materials planned to continue with it

during the next school year, and the two schools using grade 2 braille will each retain the same series used in the experiment for the following year. Only those programs using grade 1 braille felt little enthusiasm for further experimentation.

FINDINGS AND ANALYSIS

Results

The statistical analysis was limited by the nature of the study. The main purpose of the study was to develop and field test materials to be used in a larger two-year study.

The data to be analyzed consisted of scores on four variables: mental age, Slosson Oral Reading Test scores, and Gilmore accuracy and comprehension scores. The descriptive data for chronological age and IQ have been previously discussed under "Sample."

An analysis of variance for mental age, Table 9, indicates no significant difference in mental age among the four groups.

The design for analysis consisted of 2 x 2 cells using treatments of phonemic and grade 2 braille for levels of analytic (Scott, Foresman) and synthetic (Lippincott) reader approaches.

The scores from the synthetic grade 1 group were unusually low and suspect of being unreliable sources to use in the final analysis of data. For instance, all scores obtained from the Gilmore accuracy test were "zero." The range of scores on the Slosson and Gilmore comprehension tests were also very low in comparison to the other groups. This group had been introduced into the study late as a substitute for another group which was unable to participate. For this reason, the scores were dropped from the final analysis along with the scores from the other grade 1 group. The descriptive data for the participating subjects are shown in Appendix I. The ranges and mean scores on reading tests are shown in Table 10.

Certain cautions should be exercised when comparing scores of the groups. The grade 2 groups required no transition between braille codes, and they had adequate supplementary materials. The phonemic groups required a month to six weeks to make the transition to grade 2 braille. The transition required the return to pre-primer level material below the levels reached in phonemic braille in order to learn grade 2 contractions. The grade 1 groups did not have time to study grade 2 braille contractions but tests were administered in the grade 2 medium. Results of grade 2 tests administered to the grade 1 and phonemic groups would probably be

Table 9

Analysis of Variance for Mental Age

Source	ss	df	MS	F	F.95
A	47.55	1	47.55	0.71	4.41
B	66.90	1	66.90	0.89	
AB	153.27	1	153.27	2.04	
Error	1,354.58	18	75.25		
Total	1,622.30	21			

Table 10

Ranges and Mean Scores on Reading Tests

			Slosson		Gilmore A		Gilmore C	
			Range	Mean	Range	Mean	Range	Mean
L-1	Md.	1	1-6	3.30	0-0		2-7	4.00
SF-1	Ky.	2	10-41	26.00	4-26	15.00**	4-15	9.00
L-2	Mo.	3	1-118	62.00	2-37	21.57**	0-33	22.13**
SF-2	Tenn.	4	41-47	43.25	15-19	16.75**	15-19	17.25**
L-P	Va.	5	3-50	26.25	1-11	25.34**	3-12	6.50
SF-P	N.C.	6	14-45	29.17	1-35	10.50*	8-29	19.00**

Note: zero scores not included

* average by norms Grade 1.5, Form A

** above average by norms

much lower than tests administered in the initial codes.

The grade 1 and phonemic groups were also penalized by a lack of supplementary materials. Library material and classroom texts were available only in grade 2 braille. Supplementary materials in grade 1 and phonemic codes were prepared by the teachers. Braille writing which was introduced at the beginning of the year provided reinforcement for teaching of symbols in the codes.

T-tests were performed as noted in Table 11.

Table 11

T-tests of Slosson and Gilmore Scores

	Gilmore C	Gilmore A	Slosson
L_p-L_2	*3.62	*3.11	*2.22
L_p-SF_p	*4.24	0.82	0.26
SF_p-SF_2	0.71	1.46	*2.63

* $p > 0.05$

Significant differences were obtained at the 0.05 level of significance in five comparisons.

Differences in mean scores indicated that:

1. The synthetic grade-2 approach was superior to the synthetic-phonemic approach in all three comparisons, on the Gilmore comprehension and accuracy scores and on the Slosson scores.

2. The analytic grade-2 approach was superior to the analytic-phonemic approach in only one comparison using the Slosson scores.

3. The analytic-phonemic approach was superior to the synthetic-phonemic approach in only one comparison using the Gilmore comprehension scores.

In comparison with norms for Grade 1.5, Form A for seeing children (Gilmore, 1952) the following results were noted for group means:

1. Both grade 2 groups were above average in accuracy and comprehension.

2. The phonemic-analytic group was average in accuracy and above average in comprehension.

3. The phonemic-synthetic group was below average in accuracy and comprehension.

4. The grade-1 analytic group was above average in accuracy but below average in comprehension.

The disadvantage of using grade-2 evaluation materials can be noted in the following analysis of counting of contracted words in each paragraph:

Table 12

Analysis of Gilmore Paragraphs

Level	Contracted Words	Total Words
1	7	26
2	18	50
3	38	51

For example, a student missing all grade 2 contractions in the first three paragraphs could obtain a maximum accuracy score of three. The score is obtained by subtracting the number of errors from ten. After ten errors are reached, no further count is made since the minimum score is zero.

Discussion

The following discussion is drawn from the results of the *t*-tests and examination of the descriptive data.

1. Synthetic grade-2 braille approaches appear to be superior to the synthetic phonemic-braille approaches in this one-year trial. The phonemic groups were penalized by using tests in the grade 2 medium at the end of the one-year experiment. A longer transition period may have improved the scores in the phonemic groups.

2. The superiority of grade 2 braille was not as certain in the analytic approach since only one of three tests indicated a significant difference.

   The construction of the synthetic-phonemic materials had been more difficult than the construction of the analytic-phonemic materials. In many cases the phonemic braille code conflicted with the system used in the synthetic reader. There were no conflicts in the adaptation of the analytic reader. (Note previous section on preparation of materials.)

   The superiority of the analytic-phonemic approach over the synthetic-phonemic approach was further indicated by the significant difference obtained with the Gilmore comprehension scores.

3. The effectiveness of the grade-1 braille approaches was not fairly tested. MA's for subjects in one group using grade 1 braille were considerably lower than MA's from the other schools as can be noted from the raw data in Appendix I. Not one of the subjects in one school had an MA above 6-4. Only six of the remaining 29 subjects in the other groups had MA's at 6-4 or below. The relatively low performance of this group of children may have been a function of lower mental maturity.

   The scores of the second grade-1 group compare favorably with the scores in the other groups. The subjects may also have been penalized due to the short transition period from grade 1 to grade 2. It should also be noted that phonemic and grade 2 teachers appeared to be more highly motivated by the media than the grade 1 teachers. In the beginning of the study it was very difficult to find schools that would try grade 1 braille, an old system that had been discarded in

favor of grade 2 in practically all schools for the blind.

4. Neither the synthetic nor the analytic approaches showed any overall superiority. In comparison with standard norms for seeing children, grade 2 groups in both approaches performed "above average" to "superior" on the Gilmore tests.

Conclusions and Recommendations

1. Positive teacher reactions indicated that all approaches using grade 2 or phonemic materials were received with enthusiasm. The late start of a grade 1 group and low MA's of subjects in this group may have contributed to the lack of enthusiasm for grade 1 in that group.

2. Phonemic materials were developed and used successfully as measured by the results of the Gilmore and Slosson reading tests. Further exploration of such materials certainly seems warranted.

3. The early transition to grade 2 and subsequent testing in the grade 2 medium favored the grade 2 approaches. A longer transition period should have improved the scores in the grade 1 and phonemic groups.

4. Appropriate and sufficient additional materials should be prepared in ITA and grade 1 braille to supplement the basal readers. Insufficient materials in these media could handicap subjects not using the traditional grade 2 materials. Transitional materials should be designed for phasing out the experimental codes and introducing the grade 2 contractions.

5. The analytic reader is apparently more adaptable to the phonemic approach than the synthetic reader. In future studies phonemic braille should be used with the analytic approach. The randomization of subjects in a study comparing phonemic braille, grade 1 and grade 2 braille in an analytic reader seems warranted. The limited number of beginning readers could be concentrated in three approaches rather than in six approaches.

6. The use of sound and speech discrimination tests could be used to help determine the feasibility of using phonemic materials with beginning children. Phonemic materials may be especially suitable for certain children.

7. An analysis of the phonemic braille code may be appropriate. The braille symbols for sounds could be studied for the most effective arrangement of data and for the least confusion in making a transition to the braille 2 system. Tachistoscopic methods could be used to determine variations in time required to learn various tactual representations of phonemics.

8. A study of longer duration with more subjects and more adequate materials is necessary to make generalizations concerning the efficacy of approaches in braille reading.

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APPENDIX I

Raw Data

N	Media	Sex	CA	IQ	MA	RD[1]	SL[2]	GA[3]	GC[4]
1	L-1	M	70	100	70	37	3	0	4
2	L-1	M	72	94	68	46	4	0	2
3	L-1	M	80	93	74	41	5	0	5
4	L-1	M	79	89	70	51	6	0	3
5	L-1	M	91	79	72	47	3	0	4
6	L-1	F	86	77	66	46	3	0	3
7	L-1	M	94	77	72	53	4	0	5
8	L-1	F	73	75	55	0	1	0	3
9	L-1	M	102	75	76	50	2	0	4
10	L-1	M	94	73	69	24	0	0	4
11	L-1	M	104	69	72	33	2	0	7
12	L-P	F	90	111	96	63	3	0	5
13	L-P	F	76	108	80	28	50	7	12
14	L-P	M	104	90	94	53	18	1	3
15	L-P	F	98	82	80	57	34	11	6
16	L-2	F	98	90	88	50	79	25	28
17	L-2	F	98	88	86	48	76	24	30
18	L-2	F	94	83	76	0	1	0	0
19	L-2	M	107	75	80	0	66	22	20
20	L-2	F	120	65	78	0	118	37	33
21	L-2	F	120	60	72	0	63	18	28
22	L-2	F	120	59	74	0	25	2	13
23	L-2	F	95			0	68	23	25
24	S-1	F	97	85	82	47	19	4	8
25	S-1	F	89	88	78	45	41	26	15
26	S-1	M	84	82	69		34	15	9
27	S-1	M	112	80	90	28	10	0	4
28	S-P	F	96	106	104	53	39	35	29
29	S-P	M	84	99	84	38	45	20	21
30	S-P	F	90	94	86	37	14	1	8
31	S-P	M	99	93	94	54		1	20
32	S-P	M	100	84	86	48	37	11	24
33	S-P	F	91	81	76	33	21	8	19
34	S-P	M	101	75	78	50		2	15
35	S-P	M	98	73	74	54	19	6	16
36	S-2	M	89	100	89	52	43	19	19
37	S-2	M	96	100	96	49	47	18	19
38	S-2	M	92	94	87	38	42	15	16
39	S-2	F	85	88	75	46	41	15	15

[1] RD - Roughness Discrimination
[2] SL - Slosson Reading
[3] GA - Gilmore Reading - Accuracy
[4] GC - Gilmore Reading Comprehension

APPENDIX II

Phonemic Braille Code for Lippincott Series

Symbol	Braille Symbol	Example	Dictionary	Braille
a	a	at	at	at
ā	(dot 4)a	gate	gāt	g(4)at
*ä	(dots 4,5)a	was	wäz	w(4,5)az
e	e	get	get	get
ē	(dot 4)e	eat	ēt	(4)et
i	i	it	it	it
ī	(dot 4)i	fine	fīn	f(4)in
*o	o	not	not	not
ō	(dot 4)o	no	nō	n(4)o
o͞o	(dots 4,5)o	to	to͞o	t(4,5)o
oo	(dots 4,5)u	book	book	b(4,5)uk
ou	ou	house	hous	hou͡s
ow	ow	cow	kow	ko͡w
u	u	up	up	up
yo͞o	(dot 4)u	mule	myo͞ol	m(4)ul)

* Be guided by original spelling. If original spelling is o, use o. If original spelling is a, use (4,5)a except when a is followed by w, then use original spelling.

Examples: order - ôrder - orde͡r water - wôter - w(4,5)ate͡r
saw - sô - saw war - wôr - wawr

th	th	thin	thin	th͡in
th	(dot 4)th	then	then	(4)th͡en
schwa	u	alone	alōn	ul(4)on

Whole words and part-word contractions:
a I and for the

Part-word contractions:
ar (when ä was followed by r)
ed (schwa or u followed by d in root word, or when suffix is pronounced as a definite syllable as hunte͡d)
er (short e followed by r)
ch
sh
st
wh (this was used, though dictionary used hw
Ex.: while -- hwīl -- wh͡īl)
ing (used for ng sound)

As a general rule, when the dictionary gave more than one pronunciation, the one nearest to original spelling was used.

APPENDIX III

Phonemic Braille Code for Scott, Foresman Series

a	æ	ɑ	au	b	c	ch
at a	ate 4a	arm 4a 5	all 4 5 a	bed b 1,2	cat c 1,4	chap ch 1,6
d	e	ɛɛ	f	g	h	i
dog 1,4,5	elm 1,5	even 4 e	fox 1,2,4	go 1,2,4,5	hat 1,2,5	it 2,4
ie	j	k	l	m	n	ŋ
ice 4 i	jug 2,4,5	kite 1,3	like 1,2,3	mad 1,3,4	note 1,3,4,5	ring 3,4,6
o	œ	ω	ɷ	ɔi	ɔu	p
on 1,3,5	over 4 o	took 4,5 u	soon 4,5 o	oil 1,3,5, 2,4	out 1,2,5,6	put 1,2,3,4
r	ɾ	s	ʃ	ʃh	ʒ	t
run 1,2,3,5	her er	sit 2,3,4	is 1,3,5,6	shoe sh 1,4,6	measure zh	top 2,3,4,5
th	ʃh	u	ue	v	w	wh
thin th 1,4,5,6 (voiceless)	then 4 th (voiced)	up 1,3,6	use 4 u	vase 1,2,3,6	web 2,4,5,6	what wh 1,5,6
y	z					
yet 1,3,4,5,6	zip 1,3,5,6					

er her
1,2,4,5,6 e, er(sign)
girl i, er (sign)
work u, er (sign)

Whole words and whole-word contractions

a	a
I	I
and	and
	for
	the

The Initial Teaching Alphabet of 44 Sound-symbols

APPENDIX IV

Experimental Braille Teaching Program Information on Children

School _____ Teacher _____

Child _____ Birthdate _____

Date of Admission to the Class _____ Prior School Experience _____

Diagnosis of Visual Impairment _____

Visual Acuity Distance: Right Eye _____ Left Eye _____
Near (If Available) Right Eye _____ Left Eye _____

Additional Significant Information: (Include information on any prior school experience including nursery school and kindergarten) _____

Test Results:

Roughness-Discrimination Test
Date of Administration _____ Tester _____
Results _____

Interim Hayes-Binet Intelligence Tests for the Blind
Date of Administration _____ Tester _____
C.A. _____ M.A. _____ I.Q. _____
Basal Age _____ Ceiling _____
Comments: _____

Teacher Observation: Does this result in your opinion represent the prefunctional level at which this child is likely to perform? If not, could you explain your feelings? _____

If other tests have been given, please put this information on the back.

APPENDIX V

Peabody Braille Reading Project Individual Daily Records

Child's Name _____ School _____

Date	Readiness Activities	Writing Activities	New Words Introduced	Reading Activities

APPENDIX VI

Peabody Braille Reading Project

Teacher's Activities

Teacher _____
School _____
Quarter _____

Summarize readiness program for all the children (please attach copies or describe any ideas you devised that were effective).

Describe any supplementary reading exercises or books. (Send copies of exercises if possible.)

Describe your reaction to this approach to teaching reading as of now.

Are pupil's progress commensurate with your expectations at this time.

List frequent errors or confusions of students.

Other problems:

APPENDIX VII

Gilmore and Slosson Scoring Sheets

Child's Name _____

Form: A _____ B _____

School _____

Date _____

Summary Check List

_____ Many substitutions
_____ Habitual Mispronunciations
_____ Many words pronounced by examiner
_____ Habitual disregard of punctuation
_____ Habitual insertions
_____ Habitual hesitations
_____ Habitual repetitions
_____ Habitual omissions
_____
_____
_____ Word-by-word reading
_____ Reads in monotone
_____ Strained, high pitched voice
_____ Volume too loud
_____ Volume too soft
_____ Poor enunciation

Test Summary

Paragraph	Accuracy 10-No. Errors	Comprehension No. Right	Time
1			
2			
3			
4			
5			

Grade Equiv._____ No. Right _____

Rating _____

Slosson Oral Reading Test

Score

List 1 _____
List 2 _____
List 3 _____
List 4 _____
List 5 _____

Total Raw Score _____

Particular Problem Words?

_____
_____
_____
_____
_____

Reading Grade Level _____

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EDITOR'S NOTE

Readers of the *Bulletin* who do not regularly scan the Letters to the Editor of the Journal of the Acoustical Society of America may have missed the entertaining and enlightening exchange of letters concerning speech recognition studies and the difficulties of evaluating progress made in the area to date. The following items detail the exchange.

Leslie L. Clark

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A PRELIMINARY REPORT OF A PILOT STUDY ON POSTURAL BALANCING ON TRACKING EFFICIENCY OF BLIND SUBJECTS, SCHOOL YEAR 1969-70*

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Otis Budd [1]
Patti Welch[2]
K. Dyo, M.D. [3]

PURPOSE

This research was to test the use of the heel lift procedure to balance the pelvis and spine where the "short-leg syndrome" exists, in order to increase the tracking efficiency (in straight line walking) of blind subjects.

HYPOTHESIS

The hypothesis of the study was that correction of body balance on the lateral plane, with the use of the heel lift procedure, would correct lateral asymmetries of the pelvis and the spine, and of head position, through the derotation process. It was also anticipated that the neurological mechanism of body balance would become more symmetrical in function; that the gait would progress into a symmetrical pattern of bilateral step length; and that the straight line walking efficiency would therefore improve.

DESCRIPTION OF SUBJECTS (N = 58)

The subjects were students attending the Texas State School for the Blind, Austin, Texas. Only totally blind students were utilized. A total of 39 boys, age range 9 to 18, mean age 14.84 years; and 19 girls, age range 9 to 19, mean age 15.37 years were selected for the postural measurement phase of the study.

MEASUREMENT TECHNIQUES

Postural Measurements

Standing lateral postural measurements were made to determine the lateral tipping of the pelvis (posterior iliac spines), the general curvature of the spine, and the level of the shoulders. Calibrated blocks were inserted beneath the heel of the low posterior iliac spine to level it with the opposite side. The Adam's Test (of forward bending) was used before and after the pelvic leveling process to determine the functional and/or structural status of the lateral curvature.

Of the 39 boys, 34 (87 percent) demonstrated lateral pelvic

*This research project was supported in part by the University of Texas at Austin Research Institute. The present preliminary report is of the pilot phase of a two-year study now under way at the Texas State School for the Blind. In the second year of the study identical procedures will be used, and an effort will be made to extend the length of time of study during the school year.

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[2]Texas State School for the Blind (Austin).

[3]Children's Medical Center (Austin).

asymmetry of the posterior iliac spines from 6.5mm to 22 mm, mean 10mm. Nineteen were low on the left side, and 15 were low on the right side.

Three of the boys (8 percent) demonstrated levelness of the posterior iliac spines. Two of these (5 percent) showed excessive body tissue and could not be measured.

Of the 19 girls, 15 (79 percent) demonstrated lateral pelvic asymmetry from 3.5mm to 13mm, mean 7mm. Nine were low on the left side and six on the right side. Four (21 percent) of the girls demonstrated levelness of the posterior iliac spines.

Auditory screening tests were administered to all school children, including subjects participating in this study. Hearing deficiencies were recorded and evaluated for their possible influence on veering tendencies.

Tracking Measurements

A walking course was laid out on a level macadam parking surface 150 feet long and 40 feet wide. The length was marked off in 10-foot intervals and lined across the course; the width was marked in 2-foot intervals on the lines crossing the course. A center line was drawn the length of the course. A 2- by 4-inch 2-foot long board was secured to the surface at each end of the course at zero feet and at a right angle to the center line. No attempt was made to control external environmental conditions; blinders and ear plugs were not used.

Following the postural measurements each subject was administered an initial walking test on the course in two directions, north and south. At the beginning of the walking test the course was described. The subject was then placed in position with heels against the starting block and facing directly down the center line. Instructions were given to walk at a normal pace, and subject was told he would be given the command to stop when he reached the other end of the course, or when he deviated to either side curb. As the subject walked the course he was followed and the course was plotted on a record card which represented the course.

SELECTION OF EXPERIMENTAL AND CONTROL SUBJECTS

Experimental Subjects

Subjects were selected if they met the following criteria:

1. A lateral tipping of the pelvis, "short-leg syndrome," as judged by an imbalance of the posterior iliac spine, with the low shoulder on the side of the high iliac spine and general spinal curvature to the low side.

2. If in the Adam's Test, the high side of the back was on the high iliac spine side (showing spinal torque).

3. When calibrated blocks were used to level the posterior iliac spines the derotation of the spine was reduced to zero in the Adam's Test.

The subjects were measured for regular boys' and girls' shoes from a shoe contractor in Austin, Texas, and a heel lift of specified thickness as determined above was applied to the shoe to balance the lateral pelvic posture (posterior iliac spine). Since there was a problem in obtaining the required number of shoes for the proposed experimental group only 13 boys and 6 girls, or a total of 19 subjects, were actually supplied with the adjusted shoes. Their characteristics were as follows:

Thirteen boys, mean age 14.23 years, mean lateral imbalance 8mm, ten short on left side, three short on right side.

Six girls, mean age 16.7 years, mean lateral imbalance 7mm, five short on left side, one short on right side.

Control Subjects

Control subjects included 12 boys and 5 girls. Some were of the group for whom shoes could not be obtained; others were those who did not meet the criteria for postural measurement in selection as experimental subjects, but demonstrated measurable pelvic asymmetry. Their characteristics were:

Twelve boys, mean age 14.5 years, mean lateral imbalance 10mm, four short on left side, eight short on right side.

Five girls, mean age 13.2 years, mean lateral imbalance 8mm, three short on left side, two short on right side.

Subjects Not Selected for Experimental Control Group

Twenty-two subjects were eliminated from the program after the initial postural evaluation for various reasons, e.g., seven (three boys, four girls) for levelness of posterior iliac spines; three for our inability to measure them because of their excess body weight (two boys, one girl); seven (four boys, three girls) for lateral asymmetries that did not meet the basic criteria and/or appeared to be of a structural nature; one due to partial vision, and five (one boy, four girls) because they were not available for the ambulation tests.

EXPERIMENTAL PROCEDURES

Following the initial postural and tracking tests the experimental subjects were requested to wear the shoes with posture correcting heel lift at least six days a week for the remainder of the experimental period, approximately three months (March through May 1970). The members of the Physical Education Department staff assisting in the study, and the dormitory mothers, checked the experimental subjects for wearing and condition of the shoes during this period, and reported to the principal investigator when repairs were needed.

At the end of the experimental period posture and tracking tests were readministered in identical manner as the initial test, for both experimental and control groups.

PRELIMINARY STUDY FINDINGS

Findings will be reported on evidence of lateral postural correction, comparing the first and second lateral-postural evaluation, and on a comparison of the first and second tracking tests administered with subjects walking in the northerly direction.

EXPERIMENTAL GROUP (19 subjects)

Lateral Postural Measurements

Six of the boys ranged in age from 6 to 14 years. On the second test four (67 percent) had corrected to lateral pelvic symmetry by the end of the three month period of wearing the postural balanced shoes. One corrected partially, and one made no change. Seven of the boys, aged 16 to 18 years, showed no evidence of postural correction on the second test, maintaining the original lateral asymmetry. Of the six girls only one (age 17) showed a partial correction of the lateral postural asymmetry. Further explanations of these findings will be covered in the discussion section, below.

Tracking Tests (See Charts 1 and 2)

First Test. Seven (five boys and two girls) travelled the full length of the course in deviant fashion.

Second Test. Thirteen of the 19 subjects (nine boys--five repeated plus four additional; and four girls--one repeated plus three additional) travelled the full length of the course.

Ten boys definitely improved in the second attempt at straight-line walking. Four girls also improved on the second straight-line walking test. Thus, 14 of the 19 subjects (74 percent) improved their straight-line tracking pattern on the second test; two appeared to be more deviant on the second test.

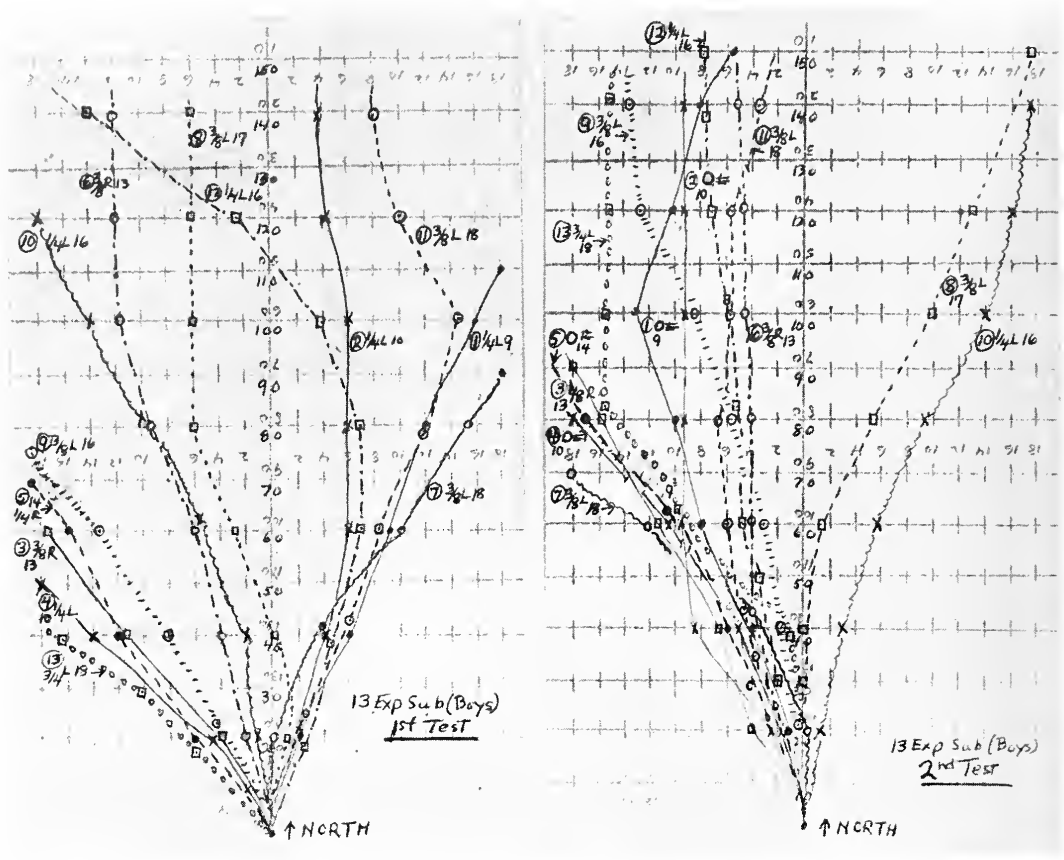

Chart 1

Thirteen Experimental Subjects (Boys)
First and Second Tests

CONTROL GROUP (17 Subjects)

Lateral Postural Measurements

Three of the five boys aged 12 to 14 years showed definite increases in lateral pelvic asymmetry, while seven boys ranging in age from 15 to 17 years, showed no evidence of increasing lateral asymmetry and remained the same as in the initial test.

One of the five girls increased in lateral pelvic asymmetry between the first and second tests.

Tracking Tests (See Charts 3 and 4)

First Test. Ten (six boys and four girls) of the 17 subjects travelled the full length of the course in a deviant pattern.

Second Test. Only six (four boys, two repeated; and two girls, two repeated) travelled the full length of the course. Three of the 17 subjects improved in straight-line tracking pattern on the second test.

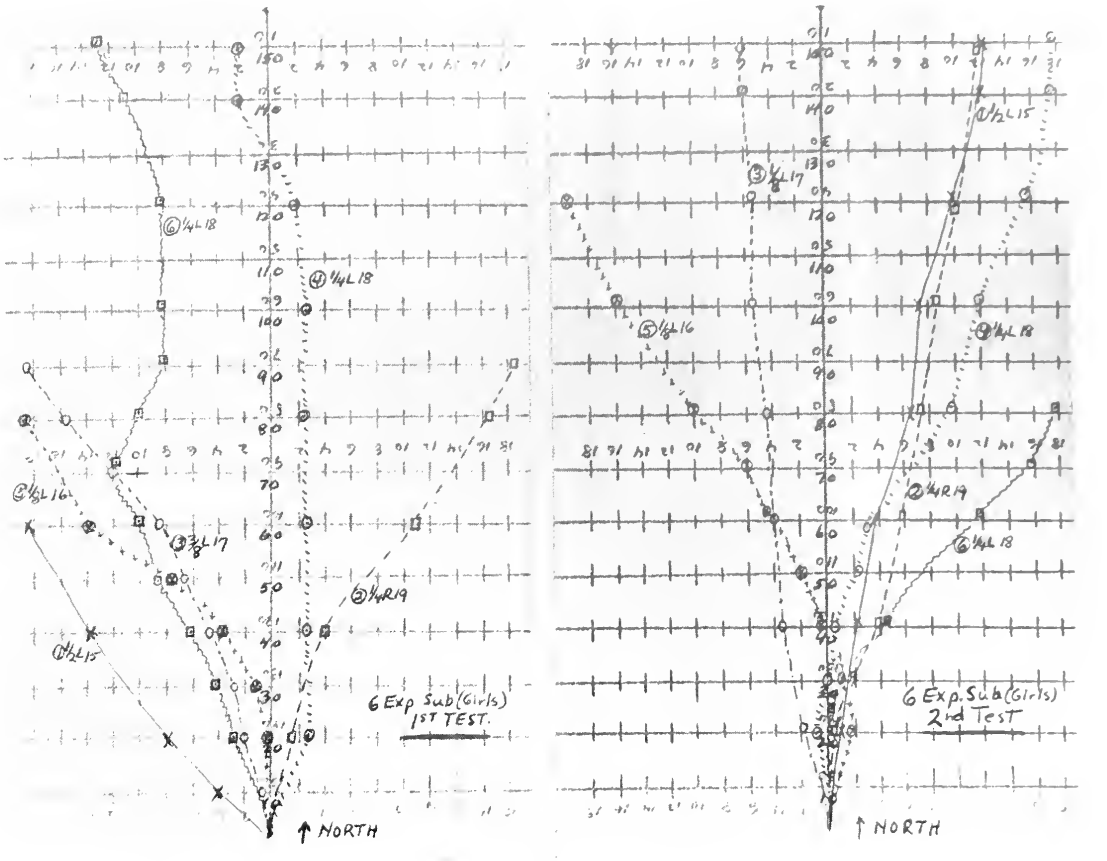

Chart 2

Six Experimental Subjects (Girls)
First and Second Tests

Discussion

The correction of the lateral pelvic tilting of four of the six male subjects (66 percent) aged 6 to 14 years, wearing shoes with heel lifts, has substantiated the lateral postural correction studies of Redler (63 percent) and Klein and Buckley (62 percent).

The evidence gathered in this pilot study indicates that lateral pelvic balancing, with the use of the heel lift on a shoe, helps in increasing straight-line tracking for blind subjects. The basic hypothesis that deviation in tracking ability would be toward the short-leg syndrome side (low posterior iliac spine) was not upheld, as only 14 (39 percent) of the 36 subjects deviated to the short-leg side on the first test; 22 (61 percent) deviated to the long-leg side. On the second tracking test only 18 (50 percent) deviated to the short-leg side.

The experimental group as a whole showed improved straight-line walking pattern, and this strongly indicates the value of the lateral postural balancing technique as an important approach for reducing veering tendencies in blind subjects. The heel lifting technique for lateral postural correction during the growing year is also substantiated.

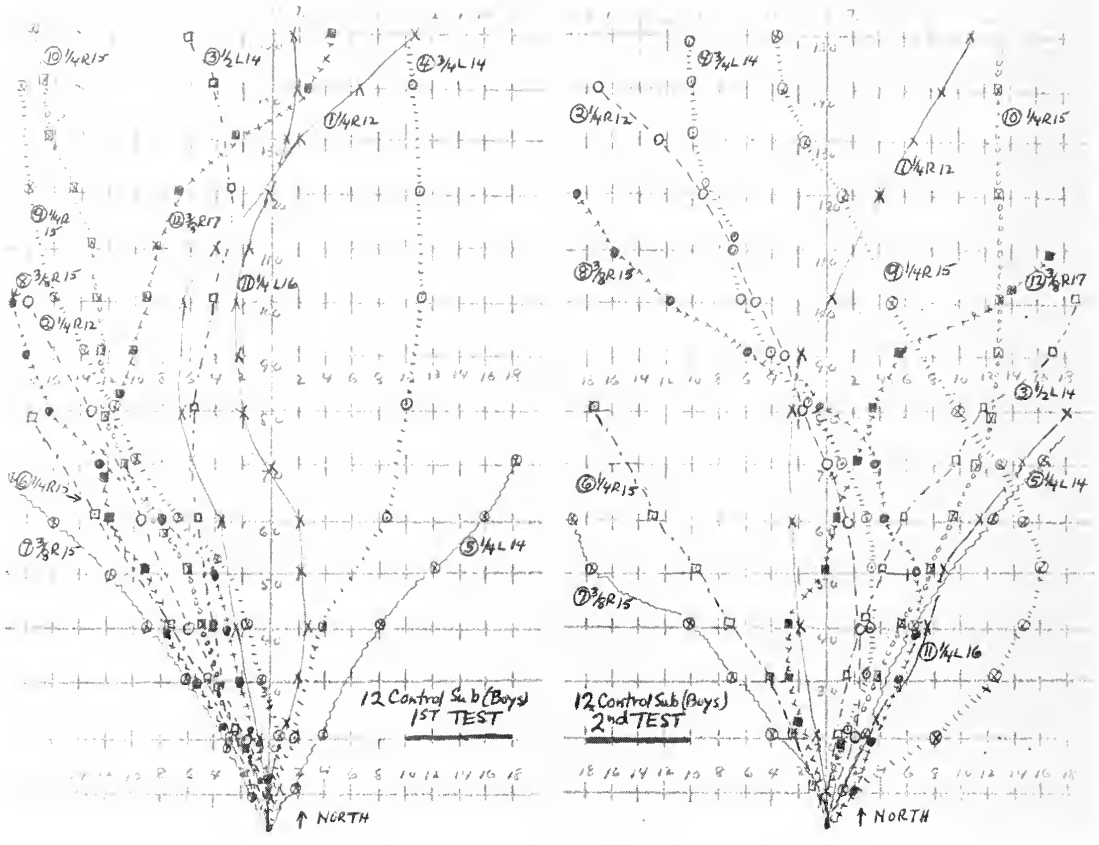

Chart 3

Twelve Control Subjects (Boys)
First and Second Tests

THE INFLUENCE OF HEARING LOSS ON SUBJECTS

Three of the experimental subjects with minor hearing loss improved on the second tracking test; and one decreased in performance on his second tracking test. Only one of the control subjects had a hearing loss, and it had no apparent influence on his tracking ability.

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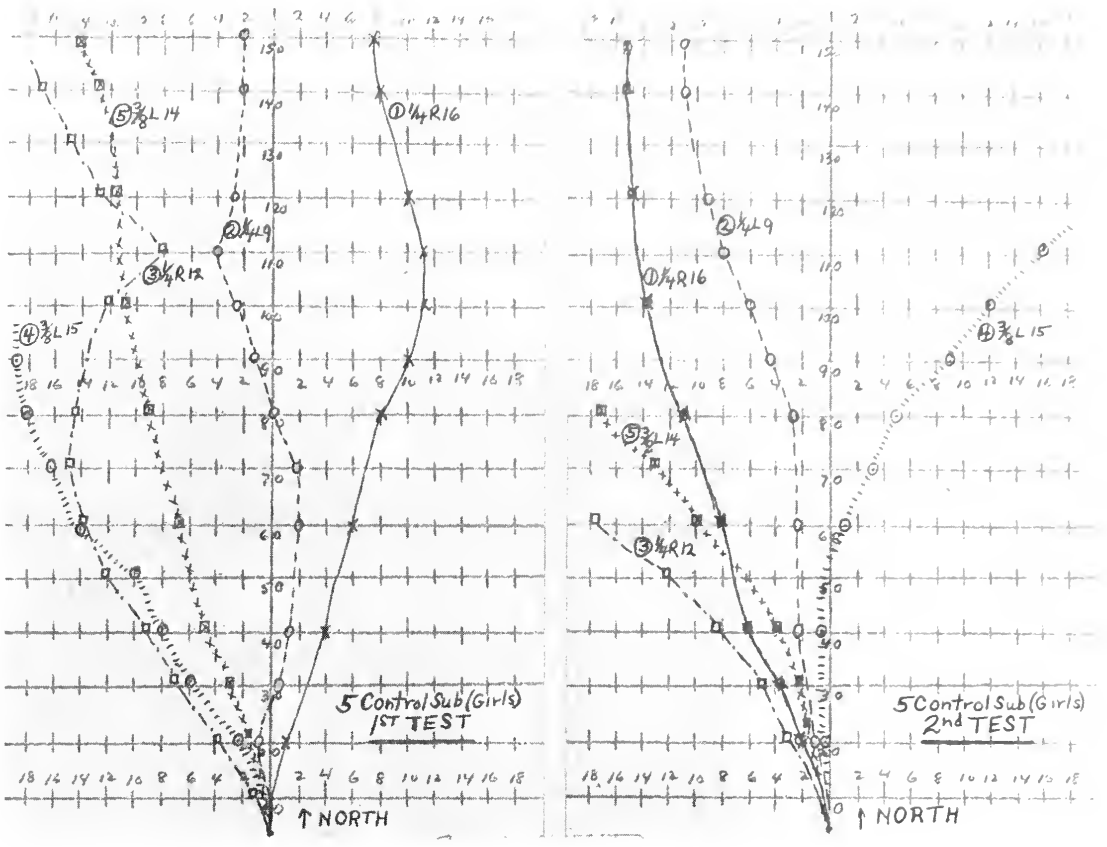

Chart 4

Five Control Subjects (Girls)
First and Second Tests

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A COMPARISON OF HARMONIC COMPRESSION AND COMPRESSION BY THE SAMPLING METHOD

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PLAN OF EXPERIMENT

Subjects

One hundred five male and female college students were drawn from psychology classes at the University of Louisville. The age range was from 19 to 45 years. Most of the subjects were classified as sophomores.

Materials

Experimental materials consisted of a social studies listening selection entitled "Franklin Pierce" (Morgan, 1959), and a 77-item, five-choice, multiple-choice instrument designed to test comprehension of the selection. "Franklin Pierce" is a 2043-word biographical sketch of the 14th president of the United States. The selection has a reading ease score of 54 which places it at tenth to twelfth grade level of difficulty. A human interest score of 31.4 classifies it as interesting reading material. Both the reading-ease score and the human-interest score were computed by Flesch formulas (1951). Split-half correlations were previously computed using data from subjects in one-day reading and listening groups. After being corrected by the Spearman-Brown formula, the reliabilities for the braille and print versions were found to be 0.91 and 0.92 respectively.

The listening selection was recorded at approximately 157 words-per-minute on magnetic tape at 7-1/2 ips, by a professional Talking Book female reader at the Center for Rate Controlled Recordings, University of Louisville. The recording was subsequently reproduced in 50 percent of the original recording time on the Harmonic Compressor at the American Foundation for the Blind. Another reproduction was made on the Graham Compressor at the Center for Rate Controlled Recordings. This recording was also reproduced in 50 percent of the original time, with the Graham Compressor adjusted to discard samples of 20-msec duration.

The comprehension test was presented in non-expendable booklets and subjects marked their answers on IBM answer sheets.

Procedure

The 105 subjects were randomly assigned to three groups of 35 subjects each. Group A listened to the Graham compression, Group B listened to the Harmonic compression, and Group C listened to the selection at the unaltered word rate. The two groups who heard the compressed material were also allowed to listen to a sample of speech compressed by 50 percent. These warm-up selections were approximately two minutes long, contained familiar material (Preamble to the Constitution of the United States), and were read by a professional male reader. All tapes were played on either a Uher or a Wollensak tape recorder. In order to equalize any differential effects that might be associated with a given recorder, approximately half of the subjects in each group listened to the appropriate tape on the Uher recorder, and the other half heard it on the Wollensak. Each subject listened by way of a stereo head set which

was connected to a device which allowed him to adjust the volume to suit his individual needs. Upon completion of the listening task, subjects removed their earphones and completed the comprehension test. Tables 2 and 3 show correlations.

Table 1

Comprehension Scores

Control C	Harmonic B	Graham A
41	54	35
66	44	50
49	29	40
35	42	43
69	59	29
60	38	43
49	41	45
44	46	42
51	41	36
53	47	48
36	47	30
21	68	33
68	49	52
45	48	37
46	50	43
41	30	49
60	56	37
43	38	48
59	32	32
42	49	47
45	58	36
49	40	21
65	43	41
57	47	40
40	68	51
65	41	50
55	51	51
62	47	40
61	53	44
32	46	27
40	32	58
53	52	30
61	53	62
58	53	48
68	19	48
$\bar{X}$ = 51.11	$\bar{X}$ = 46.03	$\bar{X}$ = 41.89

Table 2

ANOVA *A* x *B* x *C*

Source	SS	df	MS	F
Between	1495.0800	2	747.5400	6.8953**
Error	11058.0572	102	108.4123	
Total	12553.6600	104		

**(0.99 = 4.79 for df 2, 120)

F 0.99 = 4.82 for df 2,100

Table 3

Newman-Keuls Test

	A (Graham)	B (Harmonic)	C (Control)
A 1466	-	-	323 **
B 1611		-	178 *
C 1789			-

**p 0.01

*p 0.05

THE DIFFERENCE BETWEEN THE HAPTIC PERCEPTION OF SIGHTED AND BLIND PERSONS*

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The aim of the present study was to explore the difference between the haptic perception of sighted and blind persons. Groups of children and of adults were included. Twenty-six sighted children were compared with 21 blind children; and 75 sighted adults were compared with 75 blind adults. Control and experimental groups were matched for intelligence, memory, and personality.

Four experiments were conducted. In the first three experiments the recognition method was used; in the fourth, the rank-order method. To avoid practice effects the order of presentation in the experiments was varied from subject to subject.

Ten main hypotheses were proposed. For the first nine of these, several statistics were used as appropriate; for the tenth no statistic was applicable. The following statements set down the main results of the study:

1. The tactual recognition of sighted children or adults is no better than that of blind children or adults. This was true for familiar, nonfamiliar, or combined (familiar-cum-nonfamiliar), and for both simple or complex objects.

2. Both sighted and blind children show equal performance on a weight discrimination task, but sighted adults are superior to blind adults on the same task.

3. No improvement in later trials takes place in the weight discrimination task for sighted or for blind children and adults.

4. No evidence is found for the hypothesis that sighted children or adults perform more quickly on tactual recognition tasks than do blind children or adults, whether using familiar or nonfamiliar objects, or both combined; nor is there any difference noted for simple or complex objects. The same result is obtained for weight discrimination ability also.

5a. In comparisons of one object in six, using different tasks, blind children are more consistent than sighted. In similar comparison tasks, blind adults are more consistent than sighted adults.

b. No evidence supports the hypothesis that blind children obtain higher positive correlations than sighted children for different parts of any of the tasks. In contrast, however, in the case of one out of three comparisons sighted adults show higher positive correlations than do blind adults.

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*Dissertation Summary.

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6. No evidence is found for the hypothesis that sighted children obtain higher correlations than blind children between accuracy and speed in task performance for familiar or nonfamiliar objects, or for both combined. However in one out of four comparisons sighted adults obtained a higher correlation than blind adults for combined familiar and nonfamiliar objects; and in one out of six comparisons they obtained a higher correlation than blind adults for familiar objects.

7. The correlation between IQ and accuracy scores, or between IQ and speed scores, is no higher for the blind than the sighted.

8a. The correlation between memory scores and accuracy scores is no higher for sighted than blind children or adults.

b. The correlation between memory and accuracy scores for familiar objects is no higher for blind children than for sighted children. In contrast, for adults in the one out of three comparison tasks, sighted adults show a higher correlation between these two factors than do blind adults.

8c. In one out of four comparisons sighted children obtained a higher correlation between memory scores and speed on the task using familiar and nonfamiliar objects combined than blind children. No such difference was found for blind and sighted adults.

9. No significant correlation is obtained between self-sufficiency scores and scores for any of the tasks employed, whether simple or difficult.

10. As mentioned, no statistic was available to test Hypothesis X. Case histories of 20 of the blind adults are given in Chapter V of the dissertation. It is difficult from these results to come to definite conclusions about the behavior of the blind subjects in these tasks. In Chapter V, however, a short summary and some conclusions are given which demonstrate the great diversity of the individual cases.

Name: APH Electronic Variable-Speed Control

Source: American Printing House for the Blind
1839 Frankfort Avenue
Louisville, Kentucky 40206

Availability: From supplier

This control changes recorder speed without loss of power or speed stability by varying the frequencies supplied to a frequency-stabilized type motor.

Name: APH Modified Sony 105 Tape Recorder

Source: American Printing House for the Blind
1839 Frankfort Avenue
Louisville, Kentucky 40206

Availability: From supplier

Tapes may be indexed by recording a low-frequency tone which is subsequently reproduced as a high-frequency beep in the rewind or fast-forward position. The tape-lifters have been removed to allow the tape to come in contact with the head in these positions.

Name: Cable Cane

Source: HYCOR
North Woburn Industrial Park
Woburn, Massachusetts 01801

Availability: From supplier

Price: $12.00

Constructed of aluminum sections strung on a plasticized steel cable, this cane incorporates in its handle a lever which locks the sections together, giving the cane a unique rigidity. Developed at M.I.T., Sensory Aids Evaluation and Development Center.

Name: Argonne Braille Machine

Source: Dr. Arnold P. Grunwald
Engineering and Technology Division
Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439

Availability: Production prototype

Device converts symbols recorded on magnetic tape to raised braille dots on a plastic belt. The belt moves conveyor-like at an adjustable speed; the dots are "erased" by depressing them and new ones raised. With the braille machine and a plug-in keyboard the user can "write" on the magnetic tape.

Name: Code-Com Set for the Deaf and Deaf-Blind

Source: Bell Telephone Laboratories

Availability: Pre-production prototype

Used with a regular telephone, this device consists of an electromagnetic transducer which concerts incoming electrical signals to vibrations in a finger plate, a small bulb which converts the signals to light flashes and a key for sending Morse code. The device can transpose human vocal sounds as well as a dial tone, etc.; it also responds to changes in amplitude.

Name: Communication Aid for the Deaf-Blind

Source: General Electric Re-Entry Systems
3198 Chestnut Street
Philadelphia, Pennsylvania 19101

Availability: Preliminary experimentation

Initial stages of a research program outlined by Re-Entry Systems include use of frequency analysis of spectrograms and feature extraction techniques to select sound elements for tactile presentation. Anticipated is the development of a hand-held apparatus which will convert speech into identifiable signals transmitted by electro-mechanical stimulation to the fingertips.

Name: Electro-Brailler

Source: Hans Schopper
Blindenoberlehrer
Bayerische Landesschule fur Blinde
Maria-Ward, Strasse 41
8 Munchen 19, West Germany

Availability: Elektron Werk fur angewandte Elektronik GmbH
D 6992, Weikersheim/Wurtt
Postfach 34, West Germany

An electrically operated braille transcribing aid consisting of two parts: the braille transcriber, which acts as the transmitter; and the braillewriter, which acts as the receiver. The braille transcriber is an adapter mounted on a braillewriter, a braille keyboard, or an ordinary typewriter. Electrical impulses generated by this portion of the device are converted to braille dots on tape by the braillewriter. Several braillewriters can be connected to a single braille transcriber, so that a network of simultaneous communication can be created.

Name: Electronic Tracer

Source: Jens Scheel
Mechanische Gerate
Gasstrasse 16
221 Itzehoe/Holstein
Western Germany

Availability: Plasti-Graphic Supply Company
P.O. Box 268
Naperville, Illinois 60540

Price: $3,995.

An electronic engraving machine for letterpress, which can also produce embossing dies from drawings, photographs, and print. The negative and positive dies are made from the same copy and engraved into plastic 1 millimeter thick. The machine automatically cuts the negative die a little wider than the positive to allow for paper thickness.

Name: Elletro-Stereo Braille

Source: Biblioteca Italiana Per Ciechi
Regina Margherita
20052 Monze
Villa Reale, Italy

Availability: From supplier

Fully automatic braille stereotyping machine utilizes ten electromagnets operating on alternating current. Aluminum rather than zinc plates are embossed.

Name: Hard Copy and Braille Typewriter System

Source: Connecticut Technical Corporation
3000 Main Street
Hartford, Connecticut 06120

Availability: Supplier above

Price: $1950.00 (IBM typewriter not included)

A cable is connected from an electric typewriter to a Model SP200 typewriter operating unit placed over the keyboard of a standard IBM braille typewriter, permitting a simultaneous production of regular hard copy and braille copy.

Name: Illuminated Cane

Source: R. J. Willis, Jr.
Aircraft Engine Group
General Electric Co.
1000 Western Avenue
West Lynn, Massachusetts 01905

Availability: Experimental prototype

Handle of cane contains energy source, switch, and means of illuminating the cane stem. The stem, which acts as a "light pipe" can be illuminated in a constant or a pulsating manner. (Patent Application File No. 93364.)

Name: Inductive Paging System D601 for the Deaf-Blind (With Vibrating Pocket Receiver)

Source: Forschungs-und Entwicklungsgesellschaft fur orthopadische und technische Blindenhilfsmittel
D 335 Marburg
Am Schlag 8, West Germany

In collaboration with:

AEG-Telefunken
D 3 Hannover-Linden
Postfach 21345, West Germany

Availability: From Forschungs-und Entwicklungsgesellschaft

This wireless personal paging system comprises: 1. a control unit (D 620) for establishing the link between the operator and the individual user, (up to 132 persons). 2. The induction loop transmitter (D 640), which feeds two loops, each up to 270 feet long. 3. The induction loop amplifier (D 641) for use when more than two loops are required for complete coverage of premises. 4. A paging receiver (D 660) for each subscriber (up to 132). 5. The induction loops which radiate the transmitter field. The receiver (D 660) fits into the outer breast pocket. In the modified version the switching amplifier for the light call drives an electric motor (Micro T05 of Graupner). A small eccentric mass causes the complete receiver to vibrate. The receiver contains a battery which is expected to require recharging not more than once a week.

The above system will be incorporated in the new deaf-blind center scheduled to open in Hanover in 1971. Two further developments are planned: a coupling with a special extension telephone system, so that a subscriber can be signalled from a number of house telephones. He would still have to go to the operator to receive the message in braille. The final stage of development will be a teletype-like device linked to the special telephones, embossing braille on tape.

Name: Lokey Pocket Brailler

Source: Bob Lokey
c/o Mr. Stephen M. Chandler
Secretary-Treasurer
Lokey Tool, Inc.
220 Juana Avenue
San Leandro, California 94577

Availability: Preproduction prototype

The device is approximately 10 by 1-3/4 by 1-1/4 inches, and weighs 8 ounces. The keys, numbered 1 through 6, correspond to the dots in a braille cell. The space bar in the center is for manual spacing only, since the carriage is advanced automatically upon depression of one or a combination of keys. The two counterrotating rubber rollers which hold and guide the paper permit perfect horizontal and vertical line register.

Name: MIT-RLE Reading Machine

Source: Massachusetts Institute of Technology
Research Laboratory of Electronics
Cambridge, Massachusetts 02139

Availability: Experimental prototype

Calling on a basic vocabulary of 16,000 root words, suffixes and prefixes, this computer system translates written text into synthetic speech. A program that performs the grammatical parsing of a sentence permits refined selection of correct phonemes and provides information for supplying stress, intonation, and pauses. Computation of certain acoustic parameters according to physical acoustical theory, and study of the acoustic correlates of stress and pauses within specific syntactic environments, have allowed further refinements in the quality of speech produced. The machine also produces Grade II Braille and spelled speech, and will map scientific notation into braille.

Name: Mouthpiece for Microphones

Source: Christian J. Snidjers
Technische Hogeschool te Eindhoven
Postbus 513
Insulindelaan 2
Eindhoven, The Netherlands

Availability: Production prototype

The mouthpiece fits several types of microphones and enables user to record in a very low voice permitting unobtrusive note taking at meetings, lectures, etc.

Name: Phylab Brailler
(Revised Listing)

Source: Zvi Weinberger
National Physical Laboratory of Israel
Hebrew University Campus
Jerusalem, Israel

Availability: The Israel Electro-Optical Industry, Ltd.
P.O. Box 1165
Rehovoth, Israel

Produces braille cells on standard teleprinter tape. Input is low-voltage signals from microswitches operated by keys of an adapted standard typewriter. Voltage is provided by a built-in power supply. With suitable interfacing it may be adapted to accept input from computers, card readers, telex tape, and Monotype tape.

Name: Portable Brailler
(Revised Listing)

Source: Christian J. Snidjers
Technische Hogeschool te Eindhoven
Postbus 513
Insulindelaan 2
Eindhoven, The Netherlands

Availability: Production prototype

For description and diagrams see Research Bulletin No. 16, p. 215.

Name: Possum Selector Unit Type I (P.S.S.U.1)

Source: P.O.S.M. Research Project
63 Mandeville Road
Aylesbury, Bucks., England

Availability: British National Health Scheme
British Ministry of Health

The unit facilitates control of up to 11 electrical devices. Input control (either a flexible tube with pipestem mouthpiece or a microswitch) is activated until the small perspex remote-indicator unit selects the desired labeled function, which is then switched on or off. The selection is indicated by a white light traveling slowly around the indicator or by an audible clicking.

Name: Text to Synthetic Speech Conversion System

Source: Dr. Cecil H. Coker
Bell Laboratories

Availability: Experimental prototype

Computer system makes use of mathematical approximation of the shapes and motions of the human vocal tract in conjunction with assimilated rules of timing, pitch, and stress to produce "nearly natural sounding" synthetic speech. It contains a basic dictionary of work categories and definitions in digital form.

Name: UNILET Game

Source: Mr. W. Bikker
c/o Bartimeus, Institute for the Blind
Zeist, Holland

Availability: Supplier above

UNILET consists of 200 "universal letters" which can be inserted in a plastic map frame of 400 squares, enabling visually impaired persons to do crossword and other puzzles. Six pins on the letters can be raised and depressed to form braille characters without removing them from the board.

Name: Whirling Dervish Speech Compressor

Source: Grant Fairbanks Foundation
University of Illinois
Urbana, Illinois

Availability: Wayne Graham
Discerned Sound
4459 Kraft Avenue
North Hollywood, California 91602

Price: $2,950 plus shipping charges

The unit produces compressed speech by the Fairbanks method. It is designed to function in conjunction with the user's own variable-speed tape record and playback units. Input is balanced 600 ohms, and will operate with -20-decibel signal. Output is balanced 600 ohms, and will deliver 0 level with -10-decibel input. The slow loop speed (35 inches-per-second) provides a discard sample size of 18 milliseconds; fast speed (70 inches-per-second) provides a sample size of 9 milliseconds. Optional alternate speeds are available. The unit is of solid state design; it is free-standing; and its dimensions are: 19 x 14 x 12 inches; the weight is about 40 lbs.